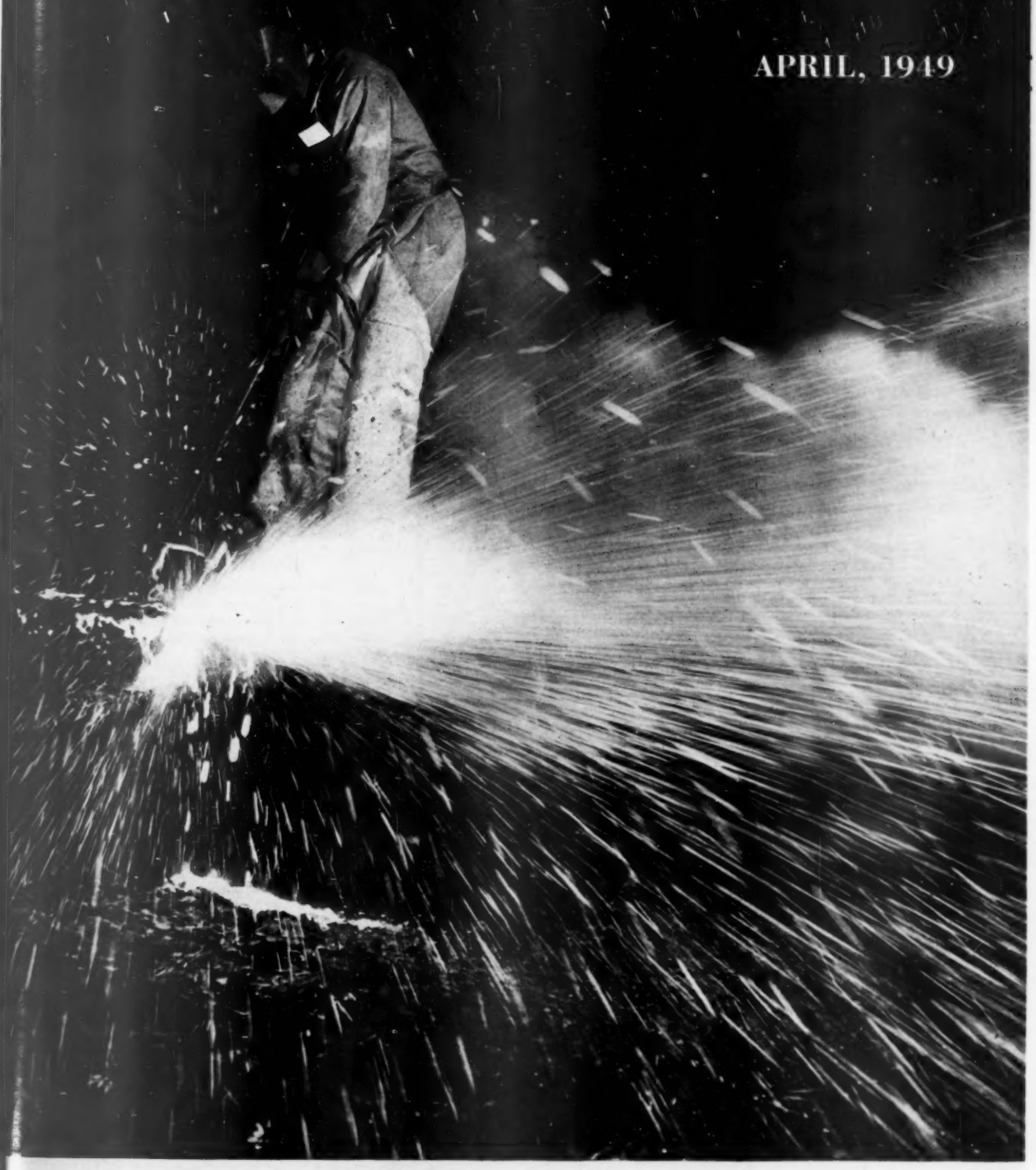
THE WELDING ENGINEER

APRIL, 1949



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A McGRAW-HILL PUBLICATION

GROUNDWORK

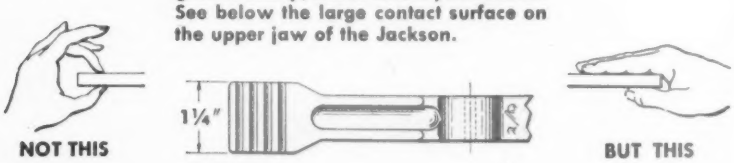
for Profitable Welding

Arc Welders must put on the heat. But only at one point: at the end of the electrode. And any heat elsewhere along the welding circuit means current wasted.

Don't rely on makeshift ground connections, inefficient and unwieldy C-clamps and plates, and on hastily made cable splices, ineffective and unstable.

Wherever connections must be made in the circuit, choose Jackson cable fittings which provide ample metal-to-metal contact to ease the flow, and stop the loss of current.

For greater metal-to-metal contact in a ground clamp, which would you choose? See below the large contact surface on the upper jaw of the Jackson.



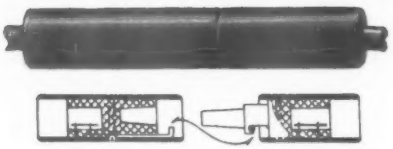
JACKSON GROUND CLAMPS

When choosing between ground clamps, take a close look at the Jackson, and note the large, flat contact surface of the copper alloy upper tong. It provides the greatest and surest conductivity between the clamp and the work.

Other features: Simple, rugged design: the upper tong for contact, the lower for pinch. Greater leverage at the "handle" end of the tongs; they go easier *on*, easier *off*.

Recent improvements: New music wire coil spring . . . complete spring insulation at both ends against accidental arcing, and to prolong spring life . . . new, larger pivot bolt for greater strength, where it counts most.

Double Economy: The Jackson Ground Clamp, eliminating loss of valuable welding current, will pay for itself in very little time. And because its price is low, you may be sure of *double economy* when you buy Jackson's.

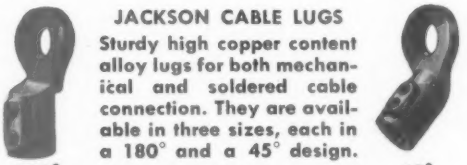


JACKSON "QUIK-TRIK" CABLE CONNECTORS

The safest way of making cable extensions. By connecting the female unit to the cable lead, the live cable end is always well insulated when not in use. Units lock tight by a twist of the hand. To avoid delays in your shop, keep your stock of replacement holders on hand with a length of cable and a male unit of the cable connector fastened to them. Then, if a holder needs replacing, get a spare and connect it in a minute.

JACKSON CABLE SPLICERS

Cable ends make adequate metal-to-metal contact with the copper alloy splicer, clamped, soldered, or brazed. For permanent, well insulated extensions; time saving, economical.



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Please specify type required

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MODEL	CABLE SIZE	CABLE CONNECTION	CAPACITY	GROUND CLAMP		CONNECTOR	SPLICER	LUG
				jaw opening	price	price	price	price
No. 1	4 thru 1/0	mechanical or soldered	300 amp	1⅛"	2.75	2.95	1.60	.80
No. 2/0	1/0 and 2/0	mechanical or soldered	500 amp	1¾"	3.50	3.75	1.85	.90
No. 4/0	3/0 and 4/0	soldered only	500 amp	1¾"	3.25	3.50	1.50	.80
				LOWER PRICES IN QUANTITIES				

THE WELDING ENGINEER

THE WELDING ENGINEER, *with which is combined The Acetylene Journal*

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Look for the

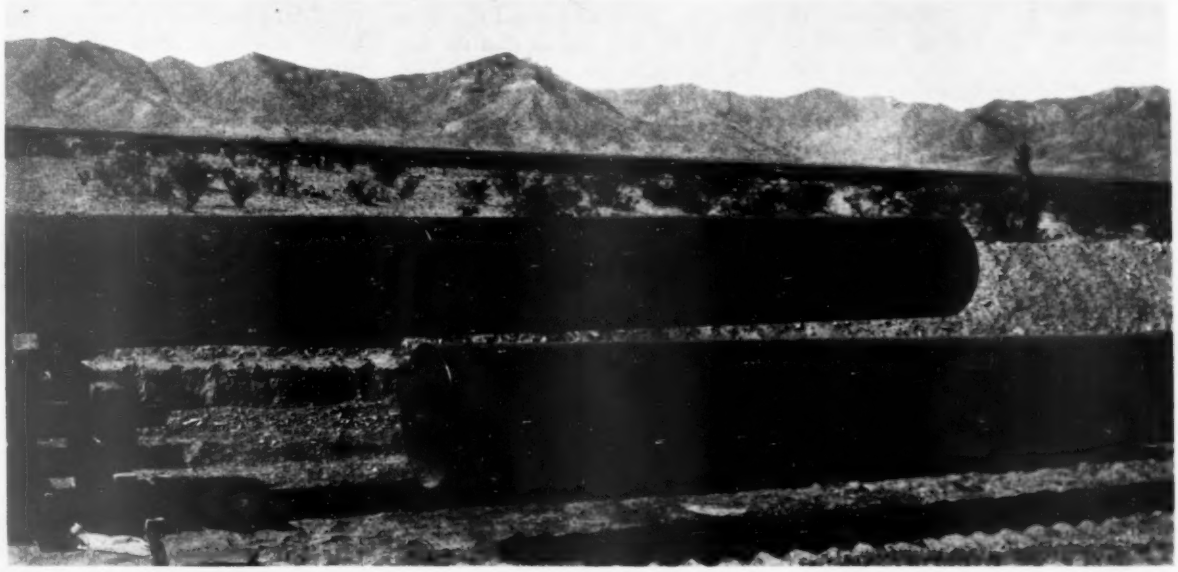
UMBRELLA PROTECTS finish weldors against the desert sun. Umbrella socket is carried on the ground clamp. The skid-mounted generator is spotted for each group of three completion welds and then moved ahead to a new setting

Pipe Lines *Across the Desert*

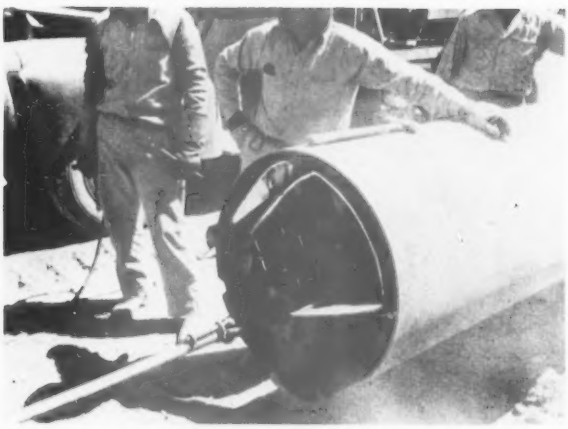
High-tensile alloy-steel pipe has complicated the task of the pipe-line contractor. However, a single spread can lay 7,000 ft of pipe per day. In the desert, welding has to be done under an umbrella

BY ELTON STERRETT

DEVELOPMENT of long-distance pipe lines for both oil and gas has brought about the use of larger and ever larger diameters. Now the line less than 20-in. diameter is regarded by the pipe-line contractor as a routine job, and equipment and personnel are geared to the fabrication of lines of 24, 26, 30 and even 36 inches in outside diameter.



LONG OVERLAPS are left between 1,000-ft sections, and expansion is equalized before the cut is made and ends joined. The cut end is stovepiped into the line, usually as spacer before wrinkle-bend section at a watercourse



WELDING CLAMP positioned at end of line in readiness for next pipe. Locating dogs (one shown at about 3 o'clock) insure proper spacing between abutting ends

CRANK at the end of the long rod is turned to align the ends. Fumes from the stringer bead in distance all but obscure the aligning clamp set in end of line

Thirty-inch pipe is now in use for many miles of through trunk line, while 24- and 26-in. lines span many hundreds of miles of desert and mountainous country in the systems linking mid-continent gas fields with west coast distribution systems.

Alloy Steel Brings Problems

Introduction of high-tensile pipe and provision of external protection instead of the earlier method of doubling wall thickness to allow for corrosion losses has brought about the use of relatively thin-walled pipe in the construction of lines above 20-in. in diameter. The high-tensile pipe, introducing the use of alloys, has greatly complicated the problem for the welding contractor. A weld, unless of approximately the same alloy composition as the adjacent pipe, offers a fertile field for the development of galvanic couples. As a consequence, the metal rapidly disintegrates as soon as accident or oversight provides a break in the protective coating to allow moisture to reach the steel.

The El Paso Natural Gas Company's pipe line from Texas across New Mexico and Arizona uses 26-in. line in two wall thicknesses for runs between compressor stations and extra-heavy pipe in all watercourse traverses. Welding techniques on the "run-of-ditch" pipe was developed to replace manual effort with power equipment wherever possible. In the clamping of pipe for welding abutting ends, for instance, an internal expanding device brings the ends to true circles and forces out any small irregularities which might have been formed as the pipe was transported to the right-of-way. Two types of clamps are used: one operated by compressed air, the other with a screw and taper operated by a long crank over which each joint is threaded.

The latter clamp carries four pairs of curved guides to bring the two pipe ends into approximate alignment. The device is set and expanded in the last welded joint and held in place with stops which automatically provide the desired gap between abutting ends for the stringer bead. When the new pipe is shoved up over the guides, further turns on the crank bring the circle of the end closely to that of the line end so that the narrow facing bevels are free of offsets and other distortion which would slow down actual welding.

Welding Programs

On the pressure side of each compressor station, 0.303-in. wall pipe or 0.291-in. pipe is laid, depending on deliveries and composition of the steel. For the thicker pipe, the program for a multibead weld calls for the following:

0.303-in. Wall Thickness

Bead	Electrode Size	Specification
First	5/32 in.	AWS E-7010
Second	5/32 in.	AWS E-10010
Third	3/16 in.	AWS E-10010
Fourth	3/16 in.	AWS E-7010

On the other weights the same welding program was used as follows:

0.291-in. or 0.281-in. Thickness

Bead	Electrode Size	Specification
First	5/32 in.	AWS E-6010
Second	5/32 in.	AWS E-7010
Third	3/16 in.	AWS E-7010
Fourth	3/16 in.	AWS E-7010

The second set of specifications is for high-tensile pipe with a tensile strength of 85,000 psi, attained in part by the chemical composition of the alloy pipe and in part by the cold-working given to the metal as the pipe is hydraulically expanded to the specified diameter. The sequence of electrodes used on the 0.303-in. pipe gives a combined bead which closely parallels the chemical composition of the pipe for which alloying alone was used to attain the 100,000-psi tensile value.

Welding procedure of the typical spread working in desert or arid areas of the country varies somewhat with the actual speed made in laying. Upwards of 7,000 feet of pipe may be laid by a spread in a day; across some desert sections where topographical conditions did not form too great a hindrance footage has reached 10,000 per working day.

Laying Stringer Beads

Working at the 7,000-ft rate, five weldors are required for the stringer beads. As soon as a new joint has been aligned by the clamp, a pair of weldors, one beginning at about 2 o'clock on the pipe circle and the

STRINGER BEADS are laid by two weldors, working on opposite sides of the pipe. The foreman (hammer in hand) will tap out signal to release the inside clamp

TWO GENERATORS are carried on truck to serve the two pairs of stringer-bead weldors. Dual leads and a common ground supply current for both welds at once

other at 8, start the stringer bead, carrying their welds along to 4 and 10 o'clock respectively. When, in the judgment of the welding foreman, sufficient bead has been run in these two sectors to maintain joint alignment, the clamp is released and pulled ahead to abut against the open end of the line. The two weldors continue their beads to complete the stringer, welding clockwise and with standard polarity.

By the time that the first pair has completed the stringer on their joint, a second pair of weldors has begun on the next joint. The first pair then "leapfrogs" over the second pair, getting ready to begin work on the third joint as soon as the pipe is aligned by the clamp. The stringer crews thus weld their beads in alternate joints.

The fifth weldor is a standby, who substitutes for one and then another of the men in each of the pairs as heat and the pace begin to tell on them. Men on the stringer beads work without protection from sun or dust. Each is relieved for the time required for one weld after he has run his fifth half-circumference bead.

The truck equipped with welding generators for the stringer bead weldors keeps pace directly behind the tractor used for aligning lengths of pipe to be attached to the completed line. The truck carries two motor-generator sets, each having dual leads so that each pair of men can be served by one of the generators.

The other three beads required to complete the joints are laid by individual weldors, each man adhering to the schedule of electrode size and composition previously outlined for the pipe being laid. The beads applied after completion of the stringer are run continuously in a clockwise direction. The only variation in procedure is that made by the individual weldor in changing his routine to obtain relief from working too long in one position. Each weldor is aided by a helper, who cleans the beads and provides electrodes as they are needed.

The number of weldors required to complete the beads depends on the amount of pipe laid per day. Records show that this number is approximately equal to the number of thousands of feet of pipe laid per day. On a 7,000-foot schedule, for example, seven weldors are required to keep pace with the stringer-bead teams.

Welds are completed in groups of three. To begin his group, a weldor spots his generator opposite the middle joint of the three and carries the lead back to the first joint and forward to the third. When a weldor has completed his trio of joints, the generator is snaked down the line to the first unoccupied set of three bare stringer-bead welds, and a new cycle is begun.

When the spread is perfectly synchronized and weldors are approximately equal in their skill and desire to work, the first shift of a closing team follows just behind the rearmost pair of stringer-bead weldors. This close timing is held desirable as it minimizes the chance of desert sand or dust settling onto the stringer and complicating the fusion of the finishing beads.

Sun Protection in Desert

The welding generators used by the completion weldors are mounted on skids. In addition to the generator and the required assortment of electrodes, each skid carries a reel for the cables, a water cooler and an umbrella for protection against the desert sun. The umbrella handle is socketed in a pipe nipple welded to the ground clamp, which is a narrow segment cut from the line pipe and sprung just enough to fit snugly over the line. Having the ground line attached to the umbrella support insures that the travel of the current through the pipe after welding will be as short as possible and not across either a finished weld or through a stringer bead alone.

Weldors are given qualification tests before being sent out on the firing line. Exceptions to this rule are men transferred between spreads, but such transfers must be approved by the spread bosses and are made only when welds on the spread where the men were earlier employed had met full specifications.

Weld testing in the line is conducted in part by the coupon method, with selections being taken at random from a weldor's daily output, and in part by gamma ray inspection. On the latter, a radium capsule is introduced into the pipe through a 15/16-in. hole drilled through the pipe wall six inches from the seam.

Bases for Shower Stalls

1—PIVOTED FIXTURE for inert-gas arc welding of shower stall base. Note toggle clamps to hold corners

2—WORK LOADED, operator is ready to start. Arc is struck on steel angle, moved over to the aluminum

Quick Welding of Aluminum F

BY WILLIAM LUKEMEIER
Division Manager, Vogt Brothers Manufacturing Co., Louisville

Simple fixtures for inert-gas-shielded arc welding enable rapid production of aluminum shower stall bases and reinforcing frames for milk bottle cases. Neither fluxing nor finishing are required

INERT-GAS-SHIELDED arc welding is being put to good use in making strong joints in aluminum products fabricated by Vogt Brothers Mfg. Co., Louisville, Ky. Among these are bases for shower stalls and frames for milk bottle cases, both of which are manufactured in considerable quantities.

Shower stall bases are first formed from 3-S half-hard aluminum sheet 0.064 in. thick. The edges of the base are flanged downward after a small square of metal has been sheared out at each corner to bring them close together. The sheared corners are then welded with a bead of the same metal.

PIVOTED FIXTURE HOLDS WORK

To facilitate the welding and insure clean, uniform beads that require no filing nor finishing, the inert-arc equipment is employed in conjunction with a 60-amp high-frequency a-c welder. The welding is done in the centrally pivoted fixture shown in Fig. 1, which is supported on a grounded shaft attached to one side of a bench. Flat radial arms extend from the hub and cross at right angles; to the four ends of these arms, angles are welded to support the corners of the shower stall base. A close fit is provided.

Each angle support carries a pair of toggle clamps, each of which has a bronze pad that is pressed against the outside of the flange of the base when the clamp is closed. With this simple fixture, the base is securely held and flange edges are brought closely together. Since the fixture is pivoted centrally, each corner can be brought successively into convenient welding position (Fig. 2).

Welding is done with a water-cooled torch provided with a tungsten electrode. A regulated supply of argon gas flows to shield the arc. The filler rods are secured by shearing narrow strips from the sheet stock used for fabrication of the aluminum bases.

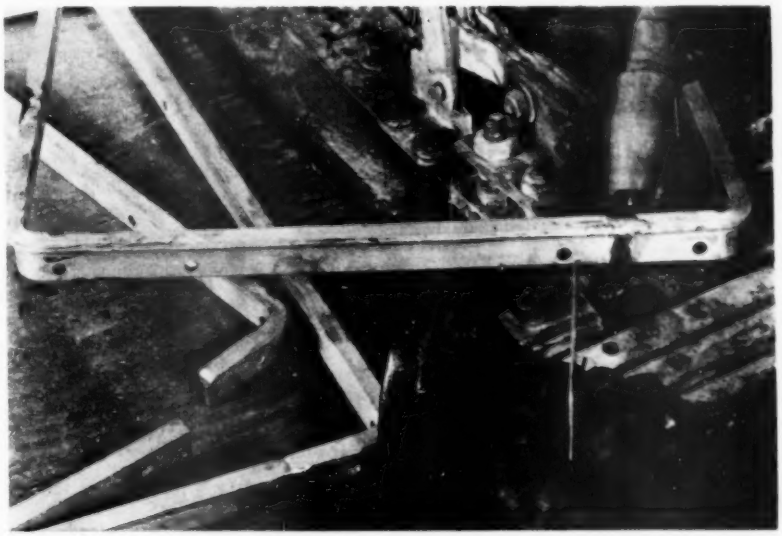
A close-up of a completed weld and one corner of the fixture appears in Fig. 3. The bead formed is smooth and is made, as a rule, in a single pass, but return pass is sometimes made if pits have been formed. Since no spatter occurs, it is not necessary to do any subsequent finishing, even with a file.

Before welding starts, the edges to be welded are wiped with a rag wetted with carbon tetrachloride in order to remove any trace of oil or grease. It is not necessary to employ a flux because the gas keeps the arc well shielded and excludes oxidizing air from the welding area. The tung-

3—FINISHED BEAD and close-up of one corner of welding fixture

Milk Bottle Case Frames

4—FIRST WELD in milk bottle case frame of extruded aluminum alloy. T-shaped extrusions to be welded are on left, clamping fixture at right



5—SECOND WELD is made without clamping frame. A bead is deposited in the V-shaped groove at top face of frame where the extrusion is thick

Products

sten electrode is not consumed and lasts almost indefinitely.

The arc is struck by touching the electrode to the steel angle adjacent to the joint and moved quickly onto the aluminum edges as metal from the aluminum filler rod is fed and fused with the molten edges. Welding is done so rapidly that a single operator can make four welds on 125 pieces per eight-hour day as well as load and unload the fixture. The aluminum bases are quite light and can be handled by the girl who does the welding.

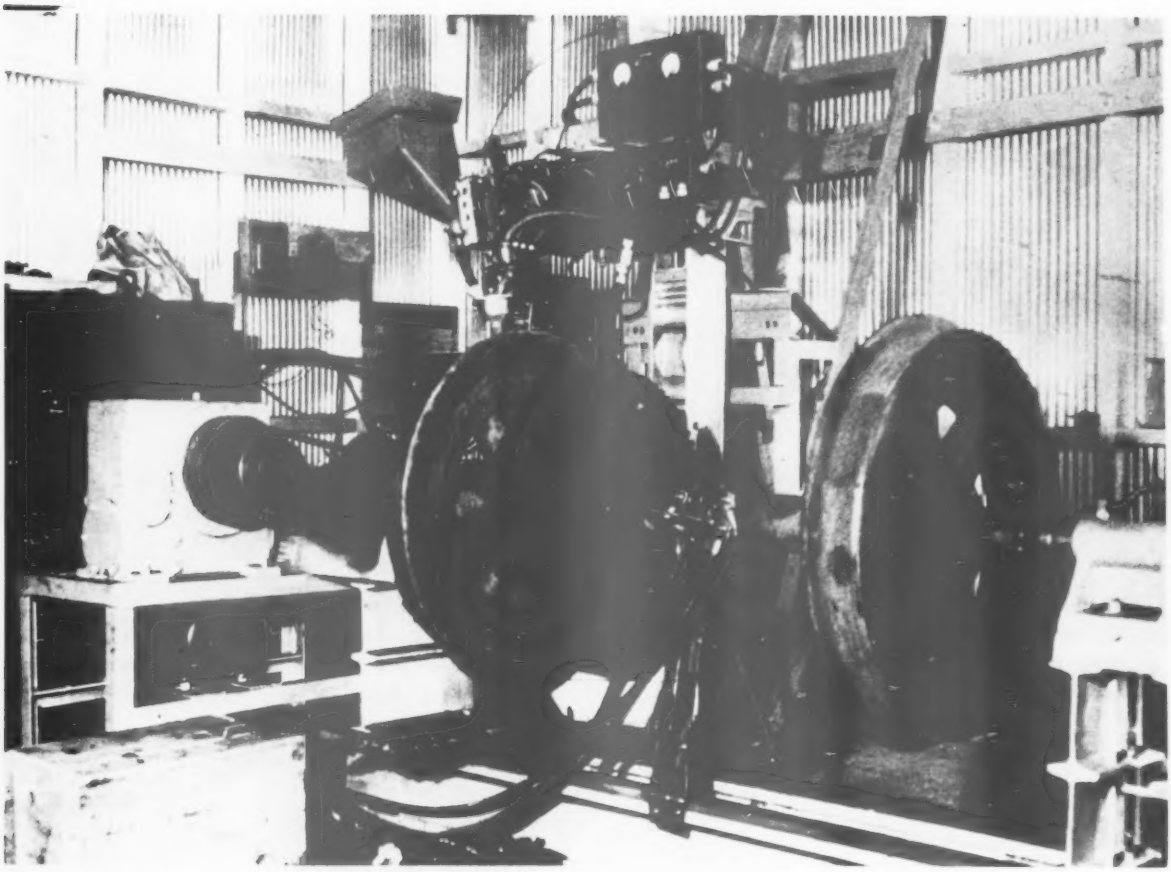
Milk Bottle Cases

Another very simple job of gas-shielded welding is done to reinforce an all-aluminum case for carrying a dozen quart bottles of milk. These light cases support a rather heavy load and often receive severe abuse which the reinforcement must withstand without breakage. Problem was to weld an extruded aluminum heat-treated molding, formed to provide an oblong reinforcing frame that is riveted to the top and bottom edges of the case.

The extrusion has a section resembling a T that has been cut off at one corner of its upper portion. Stem of the T is ½ in. deep and 0.112 in. thick. The upper portion is ¼ in. deep by 0.339 in. across. There is only one joint per frame, and it is made at a point about 3 in. from one corner. Initially, the end faces of the extrusion are sheared off square with the length, but later the top edge at each end is beveled, as is shown at left in Fig. 4, so that there will be a V-shaped groove to receive weld metal when the two ends are brought together.

In preparation for welding, the two ends are wiped clean with carbon tetrachloride and are clamped so that they butt in the toggle fixture shown in Fig. 4. This brings the thin leg of the T horizontal and the thicker upper portion vertical. While so held, the thick portion of the extrusion is partly covered by a vertical face of

(Continued on page 73)



1—OLD LATHE was converted into this fixture to rotate mine locomotive wheels for build-up. Note the "ground"

Rebuilding Wheels of

The "electric donkeys" which go deep into the earth to haul out our coal travel on wheels that are continually wearing down. Submerged-melt welding builds them up in a time of about two hours per wheel

PEOPLE who mine our coal have been looking for a good way to keep the wheels of the mine locomotives in shape. Ever since they first started to use the "electric donkeys," they have tried various methods of hand welding to rebuild the tires.

Turn to Submerged-Melt

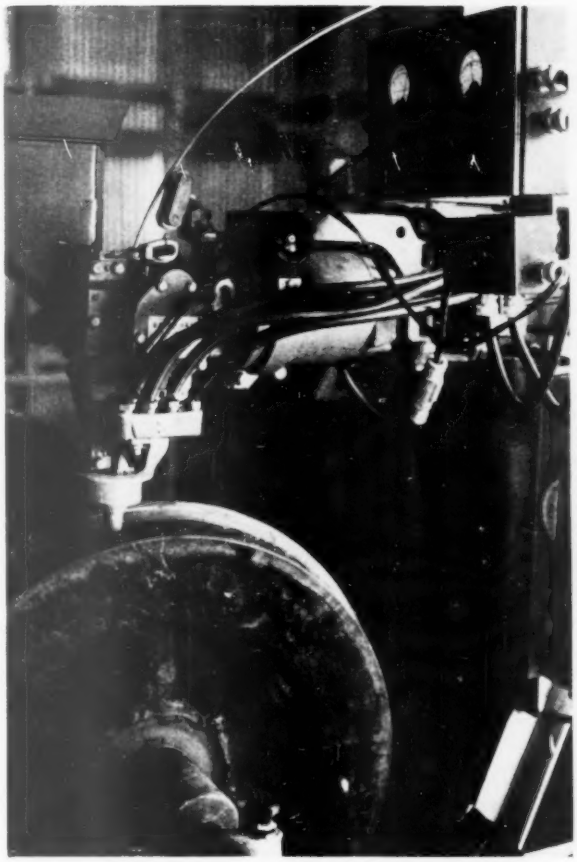
Only recently, mine operators have turned to the submerged-melt welding process for doing this type of work. Submerged-melt welding not only provides the industry with a wheel that is safe and satisfactory in service but permits greater savings than those possible with hand build-up. More and more mines are using this process.

Over 3,000 tires were reclaimed in the Williamson field alone in the first 18 months. This volume has since increased to well over 500 tires per month. Additional installations have been made throughout the West Virginia and eastern Kentucky fields.

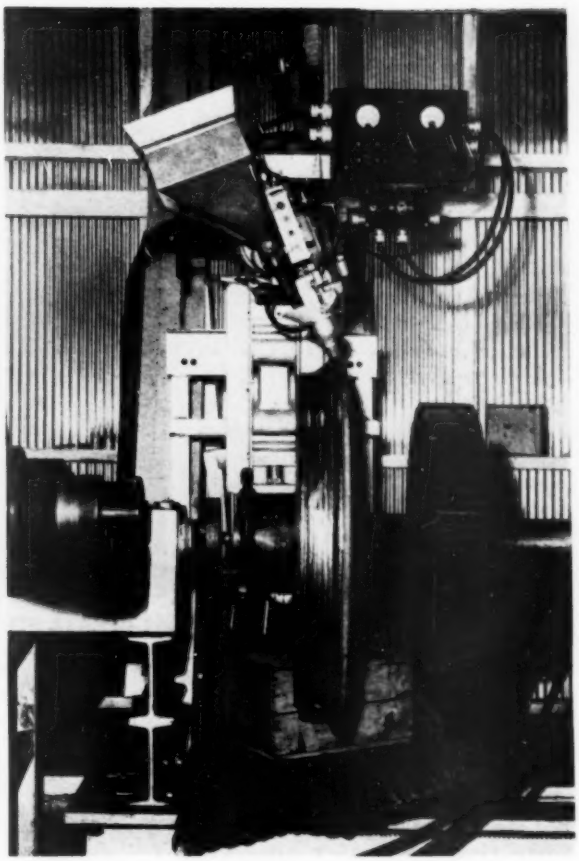
A typical installation has the capacity to rebuild 5 to 8 tires per 8-hr day. As an example, let us consider the installation at Kieley Electric Co., Harlan, Ky. This includes an electronically controlled submerged-melt welding head and a 1,000-amp transformer. The rest of the equipment was built by the men in the company's shop. Fig. 1 shows the welding fixture, an old lathe rebuilt to accommodate wheels of from 8 to 36 in. diameters. The welding "ground" brushing against the revolving axle consists of half of a bronze journal held in place by a spring-loaded hinged support. The fixture is made in such a way that the welding head and its supporting members can be shifted from one wheel to another without removing any wheels from the fixture.

Treads and Flanges Rebuilt

In Fig. 2 we see a close-up of a welding operation. The 4-in. tread of a mine locomotive wheel is being built up by the submerged-melt head. Notice that the welding wire enters



2—TREAD rebuilding. Weld puddle will be horizontal



3—FLANGE is built up by tilting welding head 15 deg

f Mine Locomotives

the point of weld slightly in advance of the top center of the wheel; this placement is made deliberately. The puddle will be formed at the exact top of the wheel and hence will not have the opportunity to run before solidification.

After a new tread has been added, the flange, too, may be built up if this is required. By tilting the welding head 15 deg (Fig. 3), a deposit may be laid on the practically vertical face of the flange.

A Wheel in Two Hours

The average wheel can be rebuilt in less than two hours and usually requires the deposition of about 30 lb of weld metal, perhaps more or perhaps less depending upon the condition and size of the wheel. Frequently, the wheels of a locomotive will wear down unevenly. The accepted practice is to rebuild them to the same diameter, even though this may not be quite the same as the original diameter. Usually it is not necessary to preheat the wheel. Enough heat is generated during welding to raise the temperature of the whole wheel to 700-800 F.

Final Machining

The rebuilt wheels are placed in a lathe and machined to the proper contour (Fig. 4). A light cut is taken to produce a smooth surface. However, the as-deposited surface is usually so smooth that some operators consider it unnecessary to finish-machine the wheels before returning them to service.

Photos courtesy The Linde Air Products Company.

4—FINISHED WHEEL is transferred to a lathe for machining

From Plate t

Started for the construction of pipe lines, Southwest Welding and Mfg. Co., Alhambra, Calif., has extended operations to include huge 15-ft penstocks. Large vessels for oil-refining are fabricated, too

BY FRED M. BURT

NO GREAT astuteness is required to deduce that welding is the predominant factor in the manufacturing operations of the Southwest Welding and Manufacturing Co., Alhambra, Calif. One of the pioneers in the development of our industry, Southwest was founded in 1914 by Andrew Lucas when "homogeneous welding" of metals was in its infancy.

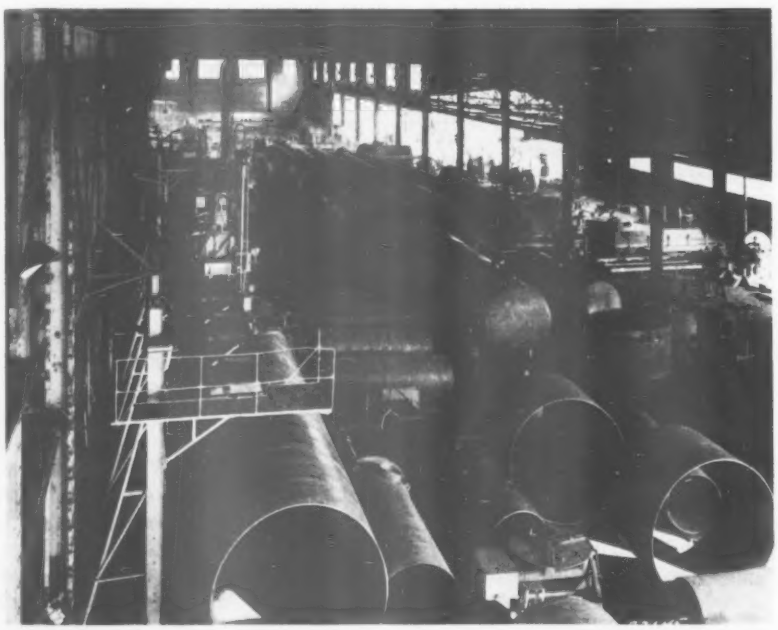
In the early 'twenties major oil fields were discovered in the Los Angeles basin, and Southwest introduced and successfully constructed welded pipe lines, gasoline absorption plants, oil-well casing, tap-ins in live pipe lines and hard-faced drilling tools. Foreseeing the demand for heavy-gauge welded steel vessels to be used in oil refining, the company expanded by building a large plant at its present location.

1—PLATE STORAGE RACKS are adjacent to the layout tables in the plant's northwest feeder bay. The man is marking plate to prepare it for cutting

Products Manufactured

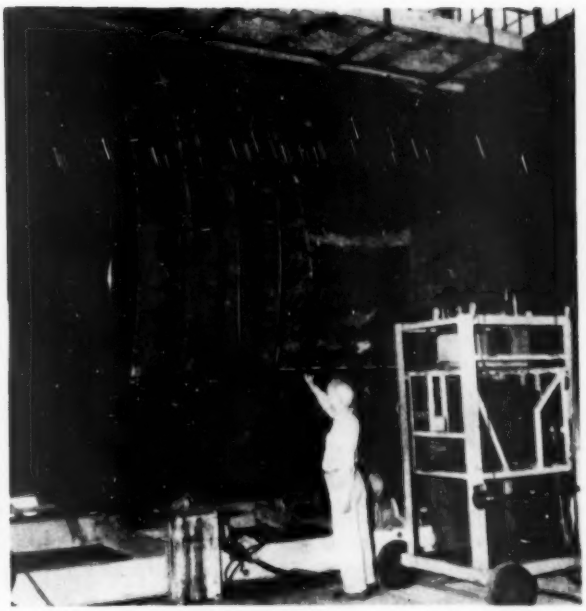
Production today runs to heavy units in diversified fields. It includes pressure vessels of all types and sizes for refinery operations, refinery piping with safety expansion joints, storage and transport tanks for liquefied petroleum gases, huge storage tanks to API specifications, stand pipes and reservoirs for water storage, heat exchangers and condensers, cooling units and special equipment such as dryers, evaporators, mixers, agitators, etc., employed by processing and chemical industries. These units are fabricated from Monel, Inconel, Hastelloy, chromium steel, stainless, stainless-clad, nickel-clad, copper, aluminum, duralumin, brass and other ferrous and non-ferrous alloys.

Industrial equipment is engineered and built by Southwest for such industries as power plants, food processing, pulp and paper, rubber manufacture, mines, smelters, foundries, cement and chemical products. Manufacturing time is shortened and replacements reduced by redesigning cast-iron and cast-steel parts to permit them to be fabricated of heavy steel plate by welding. Marine equipment includes buoys for marking and mooring that were originally designed for all-riveted construction; Southwest redesigned them for all-welded construction and secured the Navy's acceptance. Huge dry-dock caissons



4—MAIN BAY where tanks of from 14 in. up to 20 ft are welded. On the left is the overhead track, which carries a submerged-melt welding head

2—FOUR 1¼-IN. PLATES were submerged-melt-welded together to form a 20-ft length of 15-ft-diam penstock



3—COMPLETED PENSTOCK section is being inspected by X-rays to insure sound girth and longitudinal seams

e to Penstocks

were fabricated in the plant, put together within the dry dock itself and floated into place. Large penstocks for hydro-electric power stations have been prefabricated and installed at dam sites.

A later line of construction and road-building machinery includes bulldozers, loaders, hauling scoops, scrapers, earth movers, cable and rotary rippers, tamping rollers (Fig. 10), tractor cranes, sprinkler tanks, and dump-truck bodies of 30 yards and greater capacities.

From the listing of these diversified products, the initiate in welded fabrications immediately understands that here is a plant of great manufacturing flexibility. Both special single jobs and repetitive products are handled by ingenious variations in the use of standard equipment, notably submerged-melt welding. Using one or more of the dozen or so submerged-melt machines available, Southwest engineers and mechanics ingeniously fit them up for all types of practical application.

In the majority of larger oil refinery units, the following operations are necessary in the sequence given: flame-cutting, forming, fitting up, welding, testing, inspection and stress relieving.

The yard, served by a large stiff-leg crane, contains racks for storing plate, structural shapes, structural steel, pipe and pipe remnants. Adjacent to these storage racks, at one end of the plant's northwest feeder bay, are other plate racks (Fig. 1); these are next to the area used for layout work. Plate stock runs up to 5-in. thickness; standard sizes are 385-in. length by 60, 72, 84, and 96 in. widths in various gauges. This bay is served by a traveling crane.

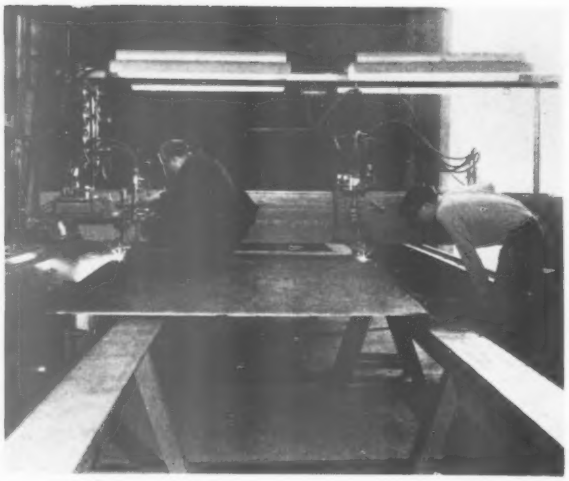
Flame-Cutting Equipment

The feeder bay also contains a large table for flame-cutting with a portable unit, a shape-cutting machine with a magnetic tracer (used for stack cutting in Fig. 5), a straight-line motor-driven cutting machine and a six-torch pantograph-type cutting machine. Other equipment includes a 400-ton, ⅝ in. by 12 ft press brake, power shears that will make straight cuts in plates up to one-inch thick and 10 ft wide, a 30-ft edge planer (used largely for stainless and alloy steels) and other forming machines.

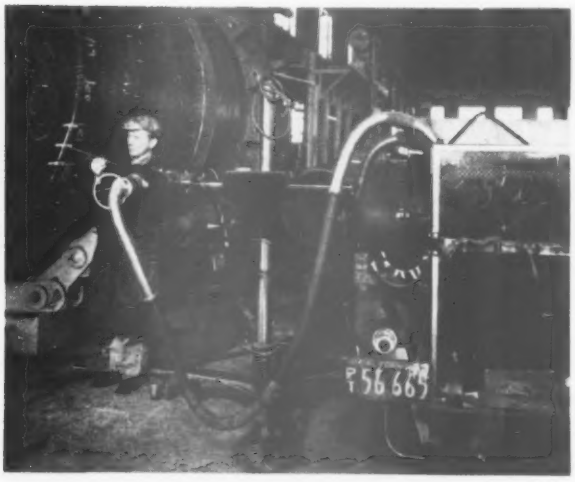
Two very interesting cutting units are a friction cut-off saw and a high-speed friction saw. The former, a circular saw 48 in. in diameter and 7/16 in. thick, has four ⅛-in. blunt teeth spaced ⅛ in. apart to every inch of the 151-in. circumference. This saw operates at 1,450 rpm. In such cutting jobs as slicing through a 6 by 2 in. steel channel (time about 8 seconds), it comes close to doing a flame-cutting job so great is the heat generated by the 1,450 teeth per second impinging upon the channel.

The high-speed friction saw has a 20-ft blade, 1-in. wide and 0.050-in. thick, with 8 teeth to the inch; it turns on two 36-in. wheels at a speed of 15,000 fpm., which means that 24,000 teeth pass the point of heating and cutting contact every second. The machine slices through solid rounds up to 1½-in., pipe up to 2 in. by 3/16 in. wall thickness, tubing up to 4 in. by ⅛-in. wall thickness and plate up to 1 in. It cuts through ¼-in. steel plate at a speed of 100 ipm and through ordinary sheet metal as though it were paper. Even such very tough objects as files, milling cutters and high-speed drills can be cut. In case of blade breakage, hy-

5—SHAPE-CUTTING machine is used here for template-guided flame-cutting of a stack of steel sheets



6—SIMULTANEOUS CUTTING crosswise and lengthwise is accomplished by a two-carriage edge trimmer



7—ROLL CARS travel on track that runs the length of building and serves several submerged-melt welders

8—TACKING HEAD to shell of a refinery vessel. Finish welding may be either manual or automatic

9—STRESS RELIEVING is done in furnace at left. The heated vessel is sometimes given a shower bath

10—SHEEP'S FOOT TAMPER for road work is a product of both submerged-melt and manual arc welding

draulic brakes stop the operation within five seconds.

To return to flame-cutting, large-diameter tank heads are trued up and beveled by rotating their edges past an oxyacetylene torch mounted at a properly adjusted angle. The rotary table will handle heads up to 20-ft diameter and turn them at any desired speed from 6 to 40 ipm.

Another Southwest-designed machine (Fig. 6) is used to flame-cut plate shapes to precision size. Plates up to 12-ft wide can be simultaneously flame-cut crossways and lengthwise. The longitudinal travel is 40 ft.

Another special machine flame-cuts heavy segments for spherical heads; the parts are held in place by magnets while a device registers the angles of cut and required bevel for welding.

Heavy steel plate is formed into many shapes on powerful hydraulic presses. In one typical operation, the flat plate is dished by dies on the outer of the two rams on a press. The head is then turned over, heated to about 2,000 F, and held in place by the outer ram holding another die. A die on the inner ram comes down to form the flange in successive operations as the head is manually revolved around a center pin.

Two jobs that get to be quite tough with heavy plate are the edge bending and subsequent roll bending to form cylinders of the proper size. A 250-ton hydraulic press has been built up to a 450-ton pressure by a special die arrangement to put the edge crimp into plate up to 4 in. thick.

Four sets of bending rolls, of 6, 10, 14 and 30 ft lengths, are in use. The latter, with a 29-in. diameter top roll and two 20-in. bottom rolls, will roll plate up to ¾-in. thick. By adding a Southwest-designed strongback, an effective roll length of 15 ft is obtained for heavy plate up to 3½ in.

Submerged-Melt Welding

It is in the longitudinal and circumferential welding of pipe, tanks and pressure vessels that some of the company's most efficient accessories, handling equipment and design ingenuities have been employed. As an example, one set-up provides for both inside and outside welding of pipe from 14 in. to 12 ft in diameter. Pipe lengths up to 30 ft (the smaller diameter) are carried on two four-wheeled dollies traveling on a track. Variable movement of from 0 to 14 fpm is supplied by a hydraulic ram beneath and attached to the dollies. Inside welding is done with a submerged-melt head mounted on a supporting arm which will allow it to travel a distance of 15 ft inside the pipe. To make an inside longitudinal weld in a 30-ft pipe, two welding heads are used. The first starts at one end and welds inwards to the center; the second starts at the center and moves outwards towards the other end.

After completion of the inside weld, the pipe is given a half turn to enable the outside weld to be made with the seam at the top. The welding head is carried on an overhead track (Fig. 4) and can be moved up and down with an electric-powered high-speed ratchet gear.

Larger pipe or tank sections are carried on roll cars (Fig. 7), which serve several submerged-melt welding machines. These cars travel on a 36-in. track that runs the length of the room. The rolls automatically center the work and accommodate all sizes of tanks. Farther down the track, sections of larger diameter, up to 20 ft, are welded on a set-up designed for general work. Still farther on is a special machine for submerged-melt welding of such oddments as manholes, fillet welds, fittings, round-abouts—everything but longitudinal seams. The submerged-melt head is fitted to the work at various angles with a positioning table or a special roller fixture; the latter has proved itself invaluable on small tank work.

Crossing this line and served by the same overhead welding head is another set-up for doing outside longitudinal and circumferential welding.

A unique Southwest development is the method of feeding the granular flux. Tanks holding 150 lb of flux were weld-fabricated and mounted on one end of the machine. The flux is fed through ¾-in. pipe under 20-psi air pressure. After welding, it is sucked to a vacuum tank through a flexible hose and carefully sifted for re-use.

Other submerged-melt machines are used to weld parts and subassemblies of the various units of construction and road machinery. Assembly work that cannot be done by this method is carried on by arc welding at several work stations.

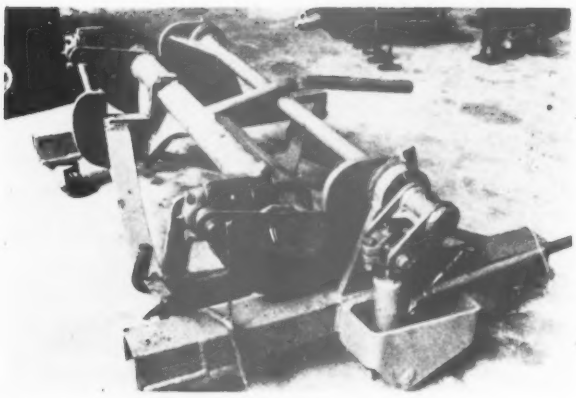
Fitting of the head of a large refinery vessel is shown in Fig. 8. After the head has been tacked to the shell by arc welding, the weld may be completed either by hand or by automatic welding, depending on which is best suited to the particular vessel. Nozzles and other fittings are similarly attached.

Many vessels, especially those with thick sections, must be stress relieved, and this is done in a furnace large enough to accommodate vessels as large as can be shipped. The furnace, shown in Fig. 9, is 16 ft wide by 16 ft high by 50 ft long; another 25 ft can be added to the length by lifting a refractory-lined dividing door. The additional 25-ft compartment can also be used separately at higher temperatures for such jobs as the stress relieving of stainless-steel vessels. Upon emerging from the furnace, the vessel may be given a water quench (Fig. 9).

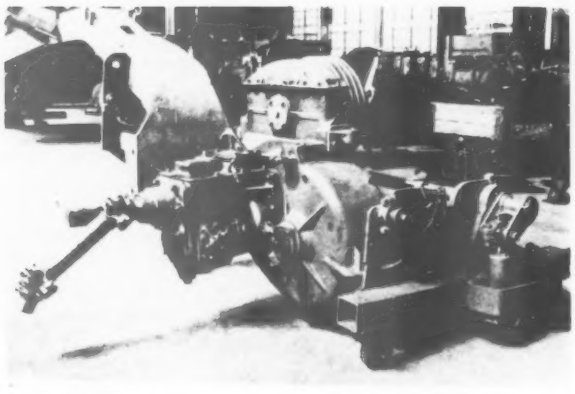
Welding 15-Ft Penstocks

A very special and extraordinary job completed about a year ago was the fabrication of 1⅓ miles of 15-ft diameter penstock for the Anderson Ranch dam in Idaho. It involved a large tonnage of plate averaging 1¼ in. in thickness. The plates were cut and rolled at the Alhambra plant, transported by rail car to a point 40 miles from the dam and trucked to a fabricating plant especially erected for this job. There the formed plates were welded into 20-ft lengths with submerged-melt heads (see Fig. 2). Each 20-ft section is composed of four plates measuring ten feet wide by slightly over 23½ ft long.

After the pipe sections had been automatically welded at the field plant, they were given a thorough X-ray examination (Fig. 3). Similar X-ray machines are used in the main plant to take radiographs of all Class I welding jobs, as is shown by the X-ray set-up in Fig. 7.



2—ROLL-AROUND JACK built by welding and flame-cutting. In upper left corner, note the square socket



3—ASSEMBLY IN PLACE, ready to roll under the grader. It must clear floor plate and cab side sills

Arc-Welded Jack S

Problem was to make a roller floor jack to support transfer case and transmission for assembly in a road grader. The 1,200-lb unit had to be rolled into position from underside of the grader frame

BY HARRY P. KRULL
Austin-Western Co.
Aurora, Ill.

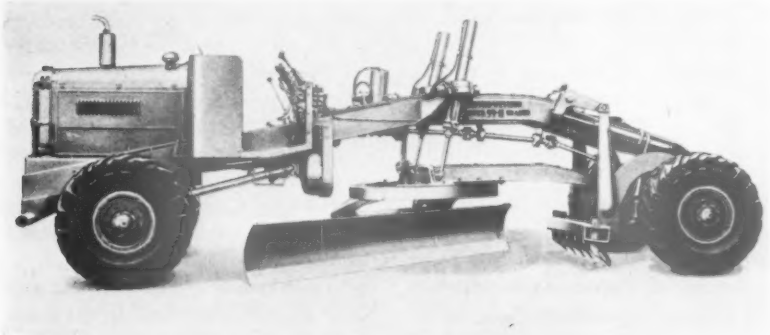
WHEN our "99-H" road grader (Fig. 1) went into production, we were confronted with the problem of devising a way to support the transfer case and transmission assembly so that it could be placed in position by two men on the assembly line.

The transfer case and transmission assembly weighs 1,200 lb, complete with grease and drive shaft. It must be brought in position from the underside of the grader frame and rolled into place, clearing the floor plate, the cab side sills and the dash plate.

Overhead Method Not Safe

Our first method was to pick up the transfer case and transmission assembly with a crane and chain sling, lower it, remove the chains and slide the unit under the grader frame; the chains were then reattached and the assembly was lifted in place. It wasn't long before the men started to worry about what would happen if the chain slipped and the man underneath, engaged in bolting the assembly, didn't look up or didn't move fast enough. Even if the chain sling could have been guaranteed safe, there was still the problem of getting the crane at the right minute since it is also being used in the first part of the production line to lift frames and other parts into assembly position.

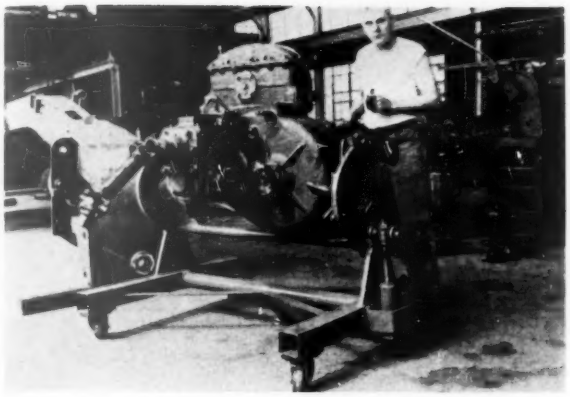
Our next move was to purchase a jack of the type used to install truck transmissions. This did not prove satisfactory because of the narrow wheelbase and our inability to construct a suitable cradle to hold the transfer case and still be low enough to get under the grader frame. The ratchet mechanism was also too slow, and the manufacturer would not guarantee the jack to be safe if loaded over 1,100 lb. Hence we decided to set the purchased jack aside and construct a roll-around jack for this special purpose.



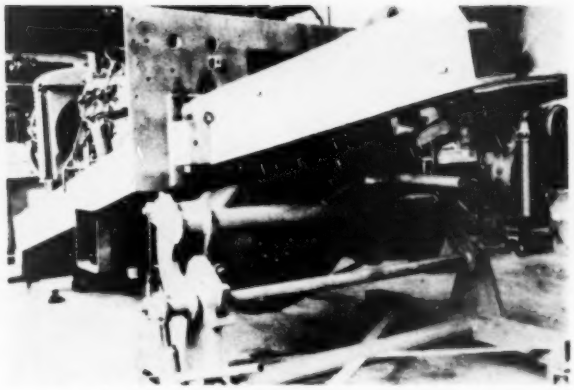
1—AUSTIN-WESTERN new "99-H" power grader. Production problem was to install transfer case and transmission assembly under the grader frame

How It Works

A three-ton hydraulic jack, actuated by the valve assembly which raises and lowers the grader blade unit, furnishes the lifting power. The jack is first rolled slightly crossways and raised a bit with a locking pin in place in order to keep the assembly from tilting too far forward. The drive shaft is slid through a hole in the bracket which supports the rear of the transmission. Then the locking pin, shown hanging from a chain on the left of Fig. 2, is removed



4—JACK RAISED to maximum lift of 18 in. Standing by it is the designer and builder, Harry P. Krull



5—UNDERSIDE of grader frame with transfer case assembled. Jack can now be rolled to the testing stand

Steps up Production

and the steering handle at the rear is grasped. The whole assembly is jockeyed up and down while being moved forward. The transfer case must be raised higher than its final position and slowly settled in place atop the frame brackets. After trying a few times, we found that it was better to install the transfer case assembly first and then pick up the motor. This made it easier to engage the spline to the drive shaft and eliminated a lot of tugging to try to steer the jack into position.

Another thing that helped was to build the jack so that it could be rocked up and down while balancing the transfer case on its center of gravity. The ball sockets used in this construction were regular stock items, and the only layout work done was to make a full-size layout of the arms to raise the cradle which supported the unit. I decided to play safe; I would start with the case resting one inch from the floor and raise it 18 in. As the centers of the lifting arms were also 18 in. from the floor, the 18-in. lift gave us a total height of 36 in. from the floor to the center of gravity. This proved ample, even though future plans called for raising the frames about 5 more inches.

In Fig. 2 the jack is in the lowered position to receive the transfer case assembly, and in Fig. 3 the unit is in place ready to roll under the grader. The case is prevented from rolling out of its cradle by the square socket, visible in the upper left corner of Fig. 2. Also clearly shown in front is the locking pin, which has a chain attached to save fumbling around. In front and below the pin is the J-bolt that holds one side of the case from slipping from the cradle. An angle is welded in place to keep the bolt from turning when the nut is tightened. The lifting handle for the jack is permanently attached as is the neighboring handle that releases the pressure and drops the cradle. All movable parts are equipped with cups for pressure lubrication.

Fooling the Boys

The discolored part of the steering handle is the result of heating and bending it to clear the high-lift brackets of the grader blade. Incidentally, the handle was not installed until a few tryouts had shown it to be necessary. It also served to cover up a fast one I pulled on the men on the line.

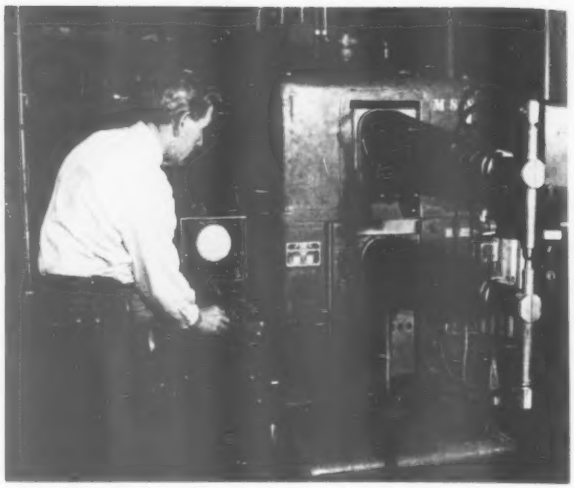
When we first set the case in place, it was too heavy on the front end because of the weight of the drive shaft. While flame-cutting the hole in the cross pipe for the handle to be welded in place, I suddenly thought of a simple solution to balance the weight. I merely poured about 75 lb of hot lead into the pipe and welded the handle over the hole. When the jack was returned to the assembly line, it looked just the same as before, and the men couldn't figure out what had been done to re-establish the balance.

The jack also serves as a stand for the transfer cases as they come off the testing station, and this eliminates another handling. The cases are assembled on special stands and rolled along a track to the testing station. It was necessary either to continue the track to roll the case out of the way after testing, or to set it on the floor to await assembly in the grader. We now set it right in place in the jack, eliminating one more crane pick-up. Fig. 4 shows the jack raised to its highest position with the author alongside it, and Fig. 5 shows it with the case in place. In the latter picture, the jack is ready to be rolled over to the testing stand to receive another complete assembly.

All of the work of building this jack was done right in our own welding department. No drawings were used, and very little material was required. First the base was fabricated and then the cradle built to hold the transfer case. A dummy case minus gears was used to lay out the arms on a piece of sheet metal. Sheet metal templates were used for shape-cutting the parts, and the assembly was arc welded together.

Photographs courtesy the Hobart Brothers Co., Troy, O.

SPOT TACKING is used to hold aircraft exhaust manifold stampings together prior to final seam welding



OSCILLOGRAPH checks the timing cycle of a spot welder. The printed curve may be analyzed at leisure

Techniques for SPOT

BY FREDERICK S. DEVER
Spot Welding Supervisor,
The Ryan Aeronautical Co.

New applications of spot welding are continually being discovered. What the designer should know about the process to do a good job is related in this excellent article coming from the aircraft industry

IN THE aircraft industry, spot welding has been used for the joining of non-structural parts and for temporarily holding parts together prior to riveting or fusion welding. Typical examples of these applications at the Ryan Aeronautical Co., San Diego, Calif., are found in the manufacture of engine cowlings and exhaust manifolds.

The process specifications which basically govern the manufacturing procedures used are those issued by the Army and Navy procurement sections. As they were first written, those specifications confined spot welding to a considerable extent and limited production applications. This was due to the fact that early equipment was not completely reliable, and its electrical circuits, moving parts and relays demanded constant and careful maintenance. In addition, spot-welding failures were encountered. It therefore appeared desirable to make the process prove itself before relaxing requirements.

With the increased accumulation of service data, it was readily foreseen at the Ryan Aeronautical Co. that the technique could be utilized to excellent advantage. It is fast, economical, flexible and adds no weight to the structure. It is particularly desirable in joining sections where they are exposed to the air stream. There is no resultant projection, and the surface exposed can be held to a maximum variation of only 0.004 in.

Indentation may be almost eliminated on one side of the sheet by selecting the proper combination of contoured electrodes. The variety of the electrodes which can be used makes the process so flexible that even polished sheet can be spot welded without seriously affecting its fine finish. Two, three or even more sheets can be spot welded together. This is possible because the process depends upon the development of maximum resistance at the inner facings of the sheets.

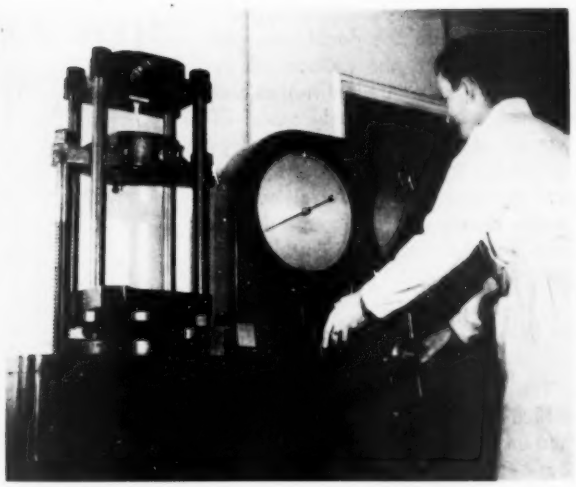
The strength of the spot weld must, of necessity, be a shear function. It follows that the design of the parts to be welded can make or break the resultant assembly insofar as satisfactory service operation is concerned. While it is difficult to list any given set of conditions as a criterion for good design, the following suggestions, developed at the Ryan Aeronautical Co., should produce desirable results:

(1) Loads to be applied to spot welds should be shear loads. If tension or angle loads are applied, the welded spots will inherently develop focal points of stress concentration at the edges of the weld and the inner faces of the sheets.

(2) Tension loadings should never be used because the strengths developed in tension are erratic and cannot be relied upon.

(3) Compression loadings are satisfactory providing the design will not allow the spot weld to be placed in tension as a result of a shifting or a movement of the compression load-

METALLURGIST peers into grain structure. Metallographic examination should be made at regular intervals



DESTRUCTIVE TESTING is likewise necessary. Here a test bar is being pulled apart by a tensile tester

T WELDING

ing. An assembly made from light-gauge material demands special care to assure that the stress does not occur in a plane which will cause buckling as the spot-weld loading changes from shear to tension.

(4) Ample edge distances must be maintained. This is necessary for two reasons: (*a*) To have a sufficient area surrounding the spot weld over which the pressure can be applied and (*b*) to have an adequate amount of wrought material so that the stresses can be carried over and around the cast weld metal.

The required edge distance will vary depending upon the type and thickness of the material. It must be remembered that as the material thickness increases the diameter of the spot weld must be increased to meet the minimum required shear loadings. The weld diameters and minimum edge distances for different metal thicknesses are given in Charts 1 and 2.

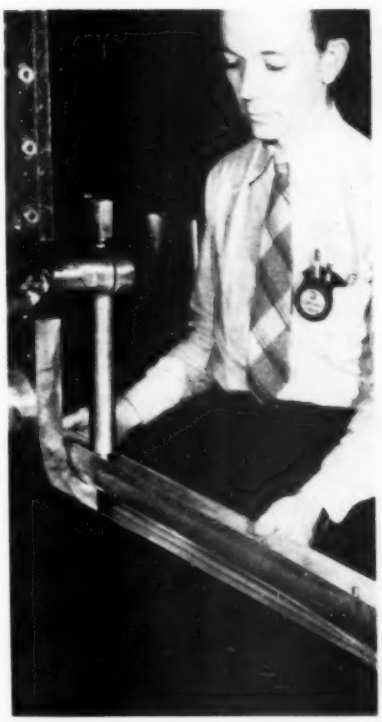
Spot Patterns

Patterns or spot groupings are of great importance in the design of spot-welded structures. They are similar to the rivet patterns and spacing used to obtain high joint efficiency. There are three rough classifications:

(1) *Single row* of spot welds with a definite center-to-center dimension. This joint pattern will require a minimum of overlapping of the sheets. The overlap will be determined by the material thickness, which (through the minimum shear strengths required) will determine the other dimensions such as spot-weld diameter and edge distance. Center-to-center spacings and a joint-efficiency graph are shown in Chart 3.

(2) *Double row* design requires a greater overlap of material, but the joint efficiency will be from 95 to 100% if the spacings given in Chart 4 are used. Even when spot-weld strengths are below average minimum, it is often good practice to utilize the double-row pattern. This is because the double row will evenly distribute the loading and result in an assembly giving a longer and more satisfactory service life than a single row of spot welds of higher average shear values. The double row has also been found to be more suitable under severe vibration and fatigue stress.

(3) *Double row staggered*. Joint



BOTTOM ELECTRODE of special design enables an inaccessible aluminum vane to be spot welded. Copper electrode has been backed with steel to secure high strength

efficiency of this pattern is approximately equal to the double-row pattern. However, the pattern of the double row staggered is not as well stressed. There is considerable difference of opinion as to which type of joint is the more efficient for general service. The material overlap in the double row staggered is less than in the ordinary double row pattern.

Wide Choice of Materials

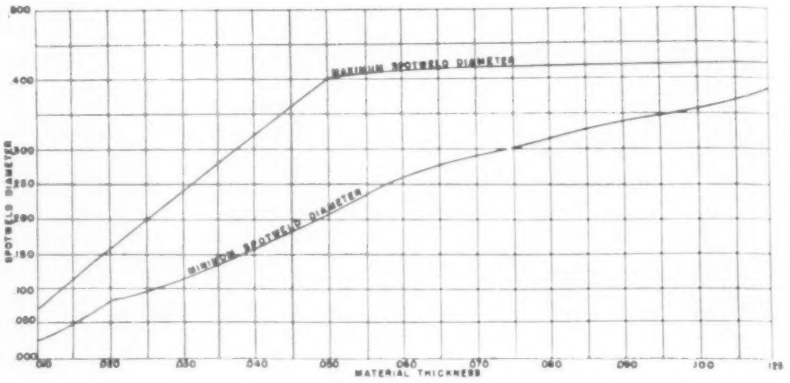
The materials which can be spot welded are almost unlimited, although those which develop extreme hardness as a result of heat treatment may present difficulties rendering spot welding unsuitable. An example of such a material would be X4130 or 4140 steel. Because of the marked reaction of these air-hardening steels, with resultant shrinkage and extreme thermal stresses, the formation of sound and uniform spots would not be possible. Low-carbon and stainless steel and many other alloy steels as well as aluminum alloys all lend themselves to satisfactory spot welding. There is, however, a marked difference between the treatment of these materials.

During the war years the spot welding of attaching plates or lugs to armor plate was accomplished with considerable success. Because of the success in this field, many technicians believe that the majority, if not all, alloy steels may be spot welded in the future. This is a possibility which is now being actively explored and is the subject of research investigations at the Ryan Aeronautical Co.

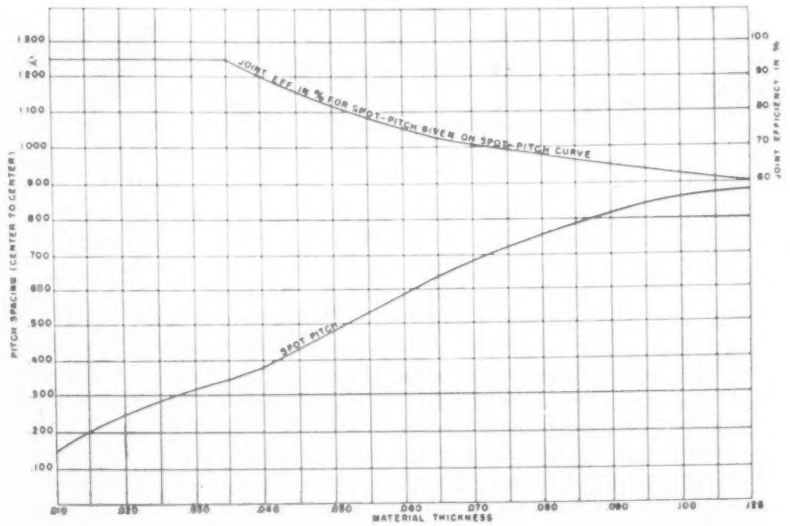
Materials having electrical resistance of equal value can be spot welded together even though their chemical composition is not the same. It is preferable, however, to weld materials of similar composition. In the aluminum alloys, we find that the electrical resistance will vary according to the chemical composition of a given alloy. The thinnest sheet is the determining factor in developing weld strengths. For this reason a wide variation in sheet thicknesses is not desirable because only a small proportion of the total strength of the thicker member can be utilized. Keeping of the thicknesses to be welded as similar as possible enables more uniform penetration and rapid production and tends to prevent critical conditions. A ratio of 3½ to 1 thickness limits between two sheets should not be exceeded.

In the absence of a design manual, the designer should consult the production man for the dimensions and clearances necessary to use existing spot welders. While the gauge combinations desired may be well within the capacity of the machine, sufficient head clearance must be allowed around the electrodes so that the holders and electrodes may enter the area to be spot welded. The use of this type of information by the design engineer will yield twofold results—sound design and increased production.

Spot-Weld Charts Facilitate Set-ups at Ryan Aeronautical Co.



1—SPOT-WELD DIAMETERS must be increased with thickness. Minimum and maximum diameters for different thicknesses are given by two graphs

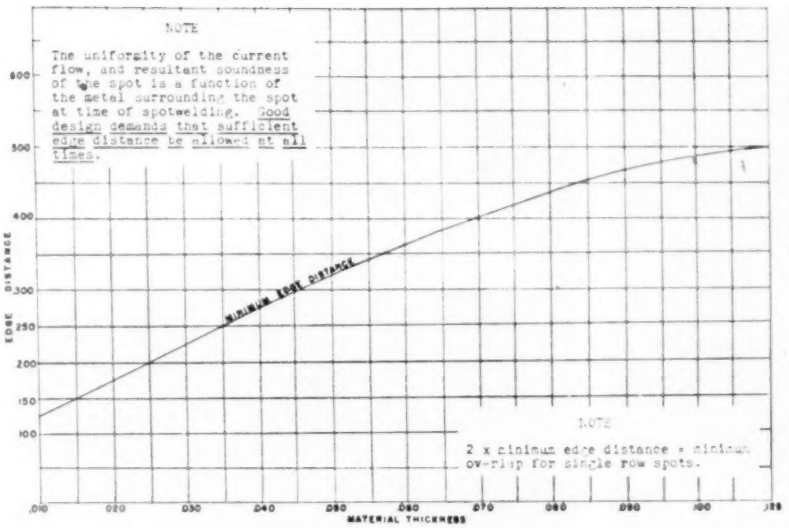

JOINT EFF. IN % FOR SPOT-PITCH GIVEN ON SPOT-PITCH CURVE
SPOT PITCH
PITCH SPACING (CENTER TO CENTER)
JOINT EFFICIENCY IN %
MATERIAL THICKNESS

3—SINGLE-ROW pattern of spot welds. Above two graphs give spot pitch (center-to-center distance) and joint efficiency for the pitch selected

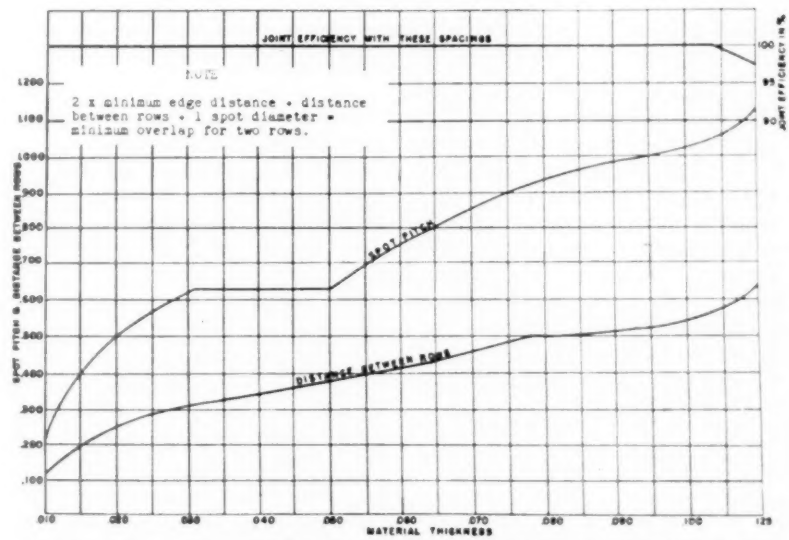
Information Needed

Below are listed a few recommendations gathered from Ryan experience as to the type of information the designer should have:

(1) Throat depth of spot welder.
(2) Distance between arms.
(3) Diameter of electrode holders.
(4) Dimensions and shapes of the electrodes commonly used by the production department.


NOTE
The uniformity of the current flow, and resultant soundness of the spot is a function of the metal surrounding the spot at time of spotwelding. Good design demands that sufficient edge distance be allowed at all times.
EDGE DISTANCE
MINIMUM EDGE DISTANCE
NOTE
2 x minimum edge distance + minimum overlap for single row spots.
MATERIAL THICKNESS

2—EDGE DISTANCES likewise increase with the material thickness. Example: For 0.040-in. material, minimum edge distance is found at 0.275 in.


JOINT EFFICIENCY WITH THESE SPACINGS
NOTE
2 x minimum edge distance + distance between rows + 1 spot diameter = minimum overlap for two rows.
SPOT PITCH & DISTANCE BETWEEN ROWS
JOINT EFFICIENCY IN %
SPOT PITCH
DISTANCE BETWEEN ROWS
MATERIAL THICKNESS

4—TWO-ROW AND THREE-ROW patterns require three graphs: pitch, joint efficiency for the selected spacing and distance between the rows

(5) Angular set-ups that are possible on the machines.

(6) Special electrodes such as offset and others.

(7) Minimum and maximum clearances required by production for the fabrication of channels, "hat" sections, Z-bars and other shapes.

It is not the intent of this discussion to persuade the reader that spot welding is an all-purpose method of manufacture. There are, however, many cases in which spot welding can replace rivets in lightly stressed assemblies. In some instances, a slight modification in the design of the part may be required. Where redesign is indicated, the increased production and decreased cost will most certainly offset the expense incurred.

Cleaning the Parts

Because of the high electrical conductivity and rapid heat transfer characteristic of aluminum alloys, surface cleanliness is one of the primary requisites for consistency in spot welds made in these alloys.

The cleaning operation will vary depending upon the material. It is undertaken for the twofold purpose of removing oils, greases and general contamination and freeing the surface of oxides whose electrical resistance would prevent a uniform current flow through the material. Considerable literature has been published regarding the most suitable cleaning methods, so only a brief summary will be given here.

Roughly, the cleaning is divided into two general types:

(1) Mechanical brushing with steel wire brushes or, in some cases, rubber-bonded abrasive wheels to lightly polish the surface of the material to be welded in the weld area. Because of the expensive labor cost and difficulty of obtaining consistently uniform results, this method has not achieved general use.

(2) Chemical solutions. A wide variety of chemical solutions are available, all of which essentially perform four functions: Step 1: removal of oil and grease: Step 2: rinsing: Step 3: removal of oxide and establishing a uniform surface; Step 4: rinsing and drying.

Stainless steels (18-8 type) may be satisfactorily cleaned for spot welding by annealing followed by a chemical pickle or rinsing. In the event the parts are oily or greasy, removal of the oils and grease should be followed by rinsing and a light acid etching.

Sandblasting is not a desirable cleaning method because a certain amount of silica from the sand is entrapped or embedded in the sandblasted surface. These silica particles offer considerable resistance to current flow and hence seriously affect weld consistency. The roughened surface resulting from sandblasting likewise prevents the development of a uniform electrical contact and current flow so that the spot welds formed vary in strength and are usually below minimum requirements.

Parts which have been sandblasted can be prepared for spot welding by annealing them at a scaling temperature followed by a regular stainless-steel chemical pickle. In cases of severe sandblasting, it may be necessary to scale and pickle the parts twice.

Assembly and Set-up

Small assemblies, normally handled by the weldor and his helper, are

WELDING GUN is counterbalanced, air-operated, water-cooled. It is used at Ryan for hard-to-reach areas

STAINLESS-STEEL products such as an aircraft diaphragm may be economically fabricated by spot welding

the rule at Ryan. These assemblies are readily secured by either spot tacking or by mechanical fasteners or clamps.

Considerable difficulty can be caused if the assemblies are not handled in such a manner as to keep them clean. Chips lodged between sheets, oil, grease and any contamination that can mar the surface to be spot welded are potential sources of trouble.

The machine set-up consists of adjusting the arms, electrodes and other elements of the welder to enable it to perform the job. The settings are obtained from charts previously established on certification tests of the machine and, of course, will be those settings for the gauge combinations about to be spot welded. After the set-up is complete, sample test coupons are spot welded and immediately tested. A shear test is sufficient to allow the work to proceed. After the test samples have been tested and approved by the inspector, the welder is ready for production.

It is recommended in all cases that machine capacity be sufficiently great so that a reserve of capacity is present for every job. Operation near the maximum current capacity is undesirable because machines are not too stable at the upper limits of their rated capacities.

Approximate welding current required for 18-8 steels is about 4,750 amp for two sheets of 0.016-in. material. Two sheets of 0.125-in. material require about 13,500 amp. Contrast these figures with the amperage requirements of aluminum alloys! Two sheets of 0.016-in. aluminum-alloy material will require approximately 14,000 amp; two sheets of 0.125-in. material about 35,000 amp. This difference should be clearly understood.

Power Variation

The required secondary amperage may be obtained either directly from an a-c transformer or through "stored energy." If an ample power supply is available, the a-c welders, single or three phase, will function satisfactorily within their rated capacities. However, difficulties may arise due to variations in the primary current. Since the secondary or welding amperage is directly related to the power input through the primary, any variation of the current through the primary will either raise or lower the secondary current. The variation may be sufficient to develop inconsistent spot welds. Power variation can cause considerable trouble when the power lines are overloaded. The installation of a separate transformer for each welder will produce the desired weld consistency, but the expense incurred must be considered.

Another approach to the problem is the interlocking system. Even though two or more welders receive their current supply from the same transformer, the current flow is controlled by timing so that only one welder can use the power input at any time a spot weld is being made.

Where a heavy power loading is the general rule, it is the practice at Ryan to use a condenser-discharge or stored-energy type of spot welder. It is scarcely necessary to explain that welders of this type store the primary current until the condenser is loaded before the current can be discharged.

Also extremely important is the time interval or "weld time" during which the current flows. The formula for heat generation, $H=I^2RT$, shows that the time the current flows will directly affect the spot weld. Since the flow is of very short duration, the timing must be quite accurate. Two means of timing are available: the mechanical timer governed by a synchronous speed motor and the electronic control.

Army and Navy Specs

In aircraft welding, the spot welder must be certified for each gauge combination used. The certi-

fication for the equipment is obtained by meeting the following requirements of specification AN W-30, a joint Army-Navy specification:

"(A) 25 consecutive specimen spot welds shall be made for each gauge combination for each welder. Twenty welds shall be tested for shear values.

"(B) The spot-weld specimens shall equal or exceed the minimum shear value for the thickness of the thinner sheet or the strength of the weaker sheet, whichever is lower.

"(C) In 18 (90%) of the 20 shear-test specimens the variation in strength shall not exceed ±12½% of the average value of the 20 specimens. The remaining 2 (10%) of specimens shall not vary over ±25% of the group average.

"(D) Remaining 5 of the 25 specimens shall be sectioned and etched to show the internal structure of the spot welds. Certain minor defects such as porosity, cracks, lack of fusion or voids are permissible if, as indicated by microscopic examination, such defects cover less than 15% of weld diameter or extend less than 25% of the respective sheet thickness."

Though there are additional requirements to be met in the specification, the above are essentially its most important considerations. From these requirements, two conclusions can be drawn: (1) Spot welding, though an accepted method of fabrication, must be carefully controlled in normal routine shop operation in order to meet consistently the rigid tests covering the certification of spot-welding equipment. (2) The amount of inspection to which this process is subjected, both in certification of the equipment and during fabrication, exceeds that required for arc and gas welding. It is logical to assume that more foolproof equipment can be expected in the future to reduce the severe inspection requirements.

How Strong Should Welds Be?

It is the practice for aircraft companies to set their minimum shear strength requirements 5 to 10% above the minima demanded by the Army and Navy. If this practice is followed, a spot weld on the border line of the company's minimum shear value will in no case fall below the AN standards.

Shear-strength values for a given gauge combination, taken over a period of months, have proved that shear values of from 10 to 15% above company minima are the easiest to maintain. It may sound contrary to common sense, but one of the chief reasons for adhering to these percentages is to avoid the natural tendency to obtain extremely high values over the minimum requirements. Extremely high values are undesirable because uniformity in shear values between individual spot welds in the same assembly is difficult to maintain. Even though all of the values are above the minimum required, a wide variation in strengths above this minimum still represents spot-weld inconsistency that should be avoided.

At the Ryan Aeronautical Co., we find that the larger the weld area, the less the ductility. The extremely high spot-weld values which can be obtained for a short time are accompanied by erratic results.

In spot welding an assembly, the operator must exercise care to keep the electrodes clean at all times. Aluminum alloys are prone to surface alloy with the copper-alloy electrodes. When this occurs, the increased resistance that develops at the tip of the electrode makes for irregular welds and prevents uniform current delivery. Besides keeping tips dressed, the operator should see that edge distance and spacing are properly maintained and also that the spot pattern is symmetrical and uniform in size.

Weld Inspection

During production runs, the inspector will check the machine at regular intervals for shear strength and weld appearance. At longer intervals metallographic examinations will be conducted. Men in the shop can make such examination by simply sectioning through the spot weld, etching the section lightly and examining it with a magnifying glass. In cases of doubt the parts can be referred to laboratory technicians for complete metallographic examinations. Should the shear strengths be below the allowable minima or should such internal defects as cracks and inclusions exceed the allowable percentages, the machine is removed from production until settings and adjustments are made that will yield satisfactory results.

Many variables can cause defective spots, so a word of caution is interjected here. The operator or set-up men should be aware that improper cooling of the electrodes, improperly dressed tips, too wide a variation from standard settings, improperly cleaned materials and many other factors can produce spot welds of unacceptable consistency. In the set-up stage, the production man can save himself considerable difficulty by exercising his full ability to do a good job.

Tips for the Inspector

Inspection of spot-welded assemblies and parts is an important phase of the work. Following are listed in sequence a few general suggestions which will give the inspector sufficient information to accept or reject the part:

(1) Inspect for appearance, noting shape and size of the spots.

(2) Inspect the spacing of the spot welds.

(3) Inspect the center of spots, for it is here that cracks are most likely to occur.

(4) Inspect for flash, both internal and external.

(5) Inspect for indentation.

(6) Inspect for sheet separation.

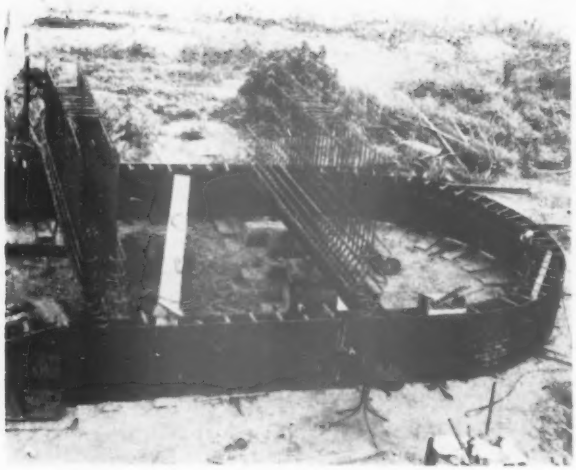
(7) Inspect for surface burning.

(8) Correlate the above with shear-test data and metallographic examination conducted earlier.

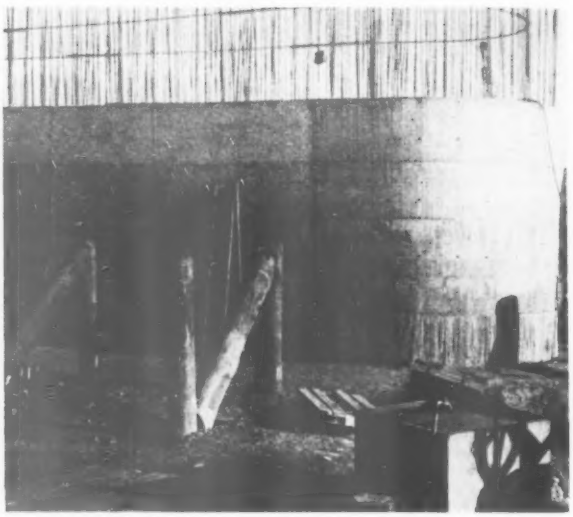
The inspector is cautioned to bear in mind that an exterior appearance of a spot on the face of the sheet is not a true indication of the internal size of the spot. He is also cautioned to be factual and objective in his analysis.

There appears to be no reason why the field of spot welding cannot be widened to include many primary structures. Quite a few applications not now considered suitable can be rather easily modified to make them acceptable for this process. Furthermore, the manufacturers of spot welders are constantly improving their electrical systems to make the equipment capable of more uniform and consistent operation.

The flexibility of the equipment, the speed and economy of operation, certainly challenge the designer and manufacturer to use this type of fabrication to the fullest.



CUTTING EDGE of 56 by 18 ft caisson to be sunk at the south bank for a pier of the bridge foundation



READY FOR FIRST SINKING. Concrete of the south bank pier caisson has been cast to a height of 15.8 ft

Welded Steel Forms

Burdekin bridge is to be carried on caissons sunk 100 ft below the river bed. Steel forms fabricated by arc welding are used for the caisson concrete. Unique welded ties were developed for these forms

BY HERBERT LEOPOLD
McGraw-Hill World News

With present rail and road traffic bridge facilities, the Burdekin river in Australia presents in periods of flood an impassable barrier to road and rail communication between the important production area of north Queensland and the south. This not only applies to coastal north Queensland but to the whole of Queensland served by the railway to the lead-zinc-copper mine at Mt. Isa and beyond, in all a total of some 220,000 sq miles.

Plan Dual-Purpose Bridge

Realizing that provision for uninterrupted communication between southern and northern Queensland is an essential requirement, the Queensland government authorized the construction of a dual-purpose high-level road and rail bridge over the Burdekin river. The design accepted provides that the lowest part of the steel on the main trusses will have a minimum clearance of not less than 10 ft above the highest known flood level at the bridge site.

The bridge site, located near the town of Ayr some 11 miles from the sea, is unlike the bridge site on the Hawkesbury river in New South Wales* in that there is no salt water. On the other hand, major flood rises and velocities occur without consequent scour of the sandy bed. After the site had been determined, the essential engineering problems were: (a) What scours were likely to occur? (b) To what depths below such scours must the piers be founded?

Ten Main Truss Spans

The new bridge is to be constructed on nine caissons and two abutments and consists of main truss spans having trestle bridging approaches to the main structure. There are to be ten steel-truss spans, each of 250 ft, three 60-ft steel girder approach spans at each side and eight 45-ft approach spans at each side, making an overall length of 3,580 ft.

The steel superstructure is to accommodate a single-track railway and a concrete roadway having a clear width of 22 ft between curbs. Total width of the bridge is to be 42 ft between the center of the trusses. The latter are to be designed for 4 ft 8½ in. gauge railway loading and to be capable of taking the heaviest highway loading, loading to be agreed upon by the road highway authorities in Australia.

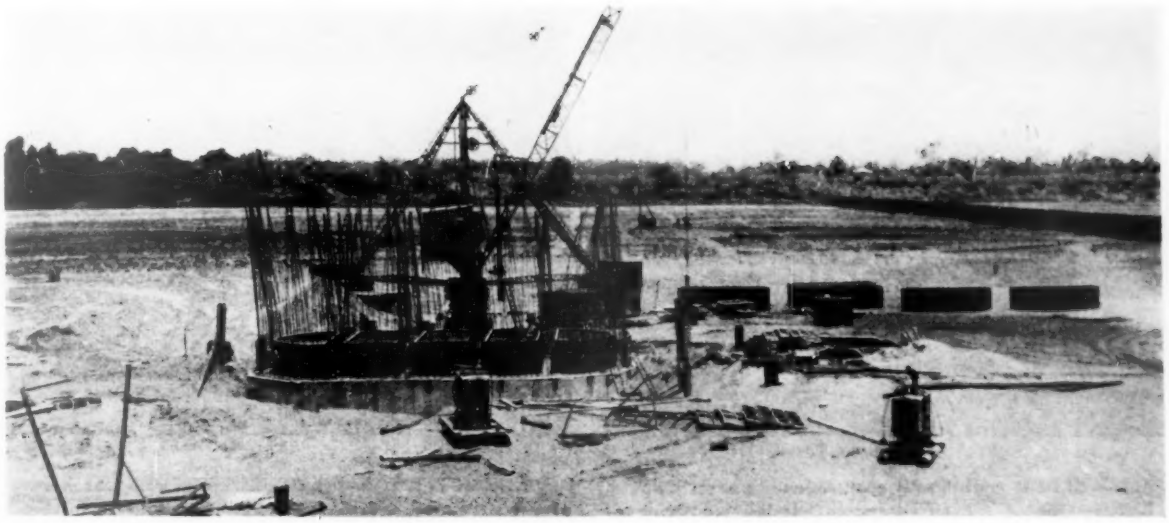
Caissons Sunk 100 Ft

The superstructure is to be founded on reinforced-concrete caissons which will be sunk to a depth approaching 100 ft below the bed of the river.

It is anticipated that the work will be completed by the end of 1950. Cost is estimated at some $6,400,000 plus interest during construction.

Through the courtesy of W. A. Rogers, secretary to the coördinator-general of public works in Queensland, The Welding Engineer has obtained unpublished details of the Burdekin bridge construction.

*See The Welding Engineer, August, 1947, p. 33.



SETTING UP steel forms for concreting 56 by 25 ft caisson of Pier 2. At time of photograph, this caisson was some 80 ft into the river bed. Note the preassembled units of inner steel forms that are waiting to be lifted in place

Build Bridge Supports

Caisson sinking was carried out by open dredging with 2-cu-yd double-line grabs operated by electrically driven stiff-leg jib cranes. Because no material for kentledge (pig-iron ballast) was available, some difficulties were experienced in the final stages of sinking; these were overcome by pumping out water from the caisson with minor excavation assistance by a diver.

First Caissons Sunk

The first river-bed working season was completed with two 56 by 25 ft reinforced caissons sunk at the main river piers Nos. 1 and 2 to the specified 100 ft into the river bed. Satisfactory foundation depths were contacted at R. L. 5.98 and R. L. 4.32.

A third reinforced-concrete caisson 58 to 18 ft was sunk about 40 ft to R. L. 102.6 at the south bank pier.

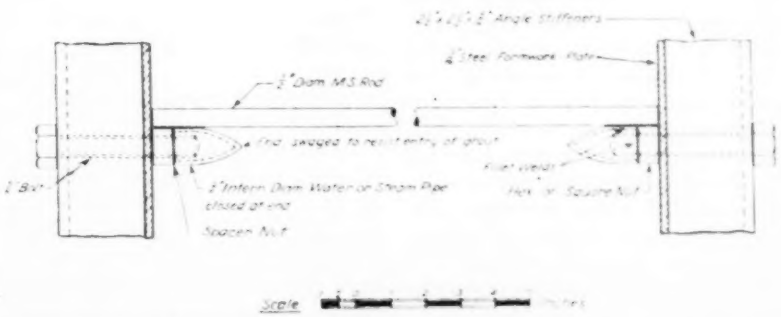
The bulk of the caisson concrete has been specified to withstand a pressure of 2,000 psi at 28 days. Altogether 5,000 cu yd, which includes 101 reinforced-concrete piles for the approach viaducts, had been placed at the present writing. The mix is prepared in two 21-cu-yd mixers in a central plant. Most of the requisite fine aggregate is won from the river bed, but fine sand and coarse aggregate is obtained at some distance from the site. The concrete is transported from the mixing plant on motor trucks in 1-cu-yd dump buckets handled into place by electric cranes.

Welded Steel Forms

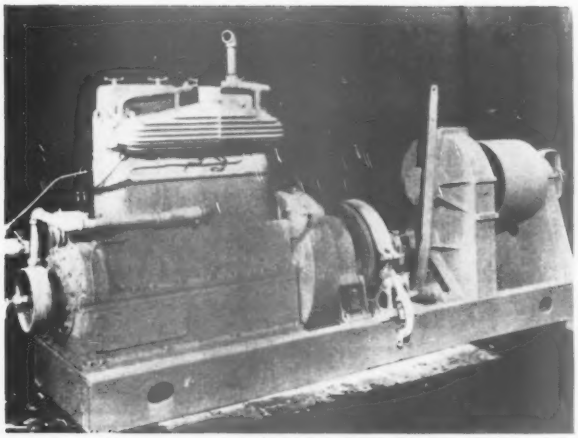
Steel forms fabricated by arc welding are used for the caisson concrete. Accompanying sketch shows how outer and inner forms are tied by ½-in. mild-steel rods and ⅝-in. bolts with spacer nuts; *i.e.*, nuts covered by a short length of ¾-in. water pipe welded to the tie ends. To resist entry of grout, the ends of the pipe are closed by swaging. This type of steel tie has proved a very effective arrangement in that a clear face to facilitate movement of forms is left when the bolts are removed. Further lifts of bolts are easily set by brackets held in the bolt holes, which also provide a hold for workmen's scaffolding.

Portion of the steel joists and girders for the approach spans have been delivered, and tenders have been called for the fabrication of 5,200 tons of steel work for the superstructure of the main spans.

Illustrations by courtesy of the Department of the Coordinator-General of Public Works, Brisbane, Australia.

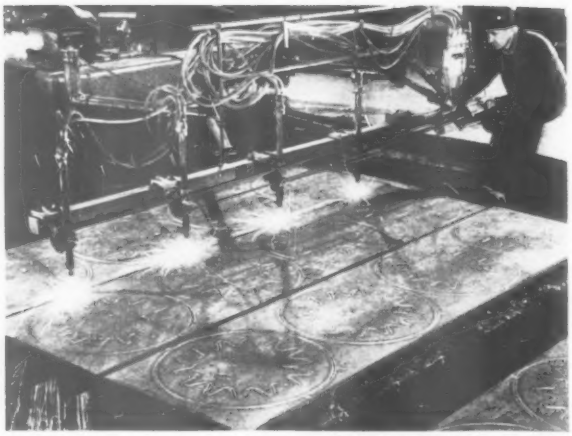


TIES FOR OUTER and inner steel forms for the caisson concrete were made from ½-in. rods, ⅝-in. bolts and nuts shielded by ¾-in. pipe



Courtesy The Lincoln Electric Co.

ALL-WELDED engine and gear reduction case is 25% lighter—one of the advantages of design for welding



Courtesy Lukens Steel Co.

FLAME-CUTTING is popular for production of heavy machinery. Here sprockets are cut by multiple torches

What Welding Means to America

★ PART THREE: Machinery — Electrical and Non-Electrical

BY T. B. JEFFERSON

This is the third of a series of articles in THE WELDING ENGINEER *discussing the extent and kind of welding used in American metal industries. These articles are based upon reports prepared from a comprehensive survey conducted by* THE WELDING ENGINEER. *The first of the series, published in the February,* 1949, *issue, was devoted to the primary metals industries. The second, March,* 1949, *issue, covered the fabricated metals industries.* — THE EDITORS.

MACHINERY, irrespective of its ultimate use, is fabricated to some extent by welding in at least 65% of the machine building plants of America. This simple fact represents a tremendous increase in the use of welding, flame-cutting and allied processes by the makers of machines during the past ten years. Many contributory factors have led to the more widespread use of welding and its allied processes. The most important of these are savings in weight, increased strength, increased durability and more pleasing appearance.*

*See "Design for Welding," THE WELDING ENGINEER, October, 1948, page 33.

The machinery survey of THE WELDING ENGINEER involved querying all plants of machinery manufacturers employing 100 or more workers and of every other plant having between 50 and 99 employees. A total 4,039 plants were covered. Of these, 2,879 were engaged in the manufacture of non-electrical machinery, including engines and turbines, machinery used in agriculture, construction, mining and metalworking machinery and special industrial machines for the factory, office or home (Table IX). Electrical machinery was found to be made in 1,160 plants meeting the above requirements of size (Table XI). The products of these plants include generating, transmission and distribution equipment, electrical appliances, wire and cable, lamps, transportation equipment and communication equipment.

NON-ELECTRICAL MACHINERY

Manufacturers of non-electrical machinery were the most responsive to the survey. Some 46%—1,330 of the 2,879 plants queried—disclosed information on their welding activities. A 43% response was received from the electrical machinery plants —499 out of 1,160 plants.

In the non-electrical machinery plants, welding was used for either maintenance or production purposes in 91% of the 1,330 plants that answered the survey questionnaire. The amount of welding and cutting used varied among the respondents from a low of 82% in plants producing metalworking machinery to a high of 98% in plants making construction and mining machinery and equipment. Most makers of non-electrical machinery registered a 90% or greater use of welding for each of the groups listed in Table IX.

Maintenance welding is used in 91% (1,102 plants) of the 1,209 machinery plants that do welding (Table X). As is true of the plants previously surveyed, arc welding is the predominant process for maintenance; it is in service in 983 plants or 89% of the plants that do maintenance welding. Of the latter 1,102 plants, 84% (931) are using oxy-acetylene welding and flame-cutting for maintenance purposes; 14% (156 plants) use resistance welding in one or more of its many forms. The discrepancy in the totals is accounted for by the fact that many plants use more than one welding process—arc, gas and resistance welding as well as flame-cutting.

From a production standpoint, 84%—1,011 of the 1,209 plants re-

Table IX. Analysis of Respondents by Industries—Non-Electrical Machinery

Machinery (except electrical)	Plants Surveyed	No. Plants Responding	Do Welding Number	Do Welding Percent	Do Not Weld Number	Do Not Weld Percent
Engines and turbines	76	52	48	92	4	8
Agricultural machinery and tractors	211	127	123	97	4	3
Construction and mining machinery and equipment	290	145	142	98	3	2
Metalworking machinery	656	282	231	82	51	18
Special-industry machinery	563	259	232	90	27	10
General industrial machinery and equipment	595	251	233	93	18	7
Office and store machines and devices	132	59	52	88	7	12
Service-industry and household machines	256	109	105	96	4	4
Miscellaneous machinery parts	100	46	43	93	3	7
Total	2,879	1,330	1,209	91	121	9

Table X. Maintenance and Production Welding

Machinery (except electrical)	Maintenance Welding Total*	Arc	Gas	Resistance	Production Welding Total*	Arc	Gas	Resistance
Engines and turbines	45	38	41	4	36	33	23	14
Agricultural machinery and tractors	115	111	104	12	119	109	76	63
Construction and mining machinery and equipment	131	125	103	16	130	126	81	28
Metalworking machinery	218	182	172	22	166	124	112	67
Special-industry machinery	211	191	180	33	204	192	164	80
General industrial machinery and equipment	208	189	174	31	192	175	123	66
Office and store machines and devices	44	35	36	11	44	25	26	32
Service-industry and household machines	89	80	81	23	97	84	75	67
Miscellaneous machinery parts	41	32	40	4	23	19	13	9
Total	1,102	983	931	156	1,011	887	693	426

**The figures for arc, gas and resistance welding exceed the total because of duplication of types of welding within plants.*

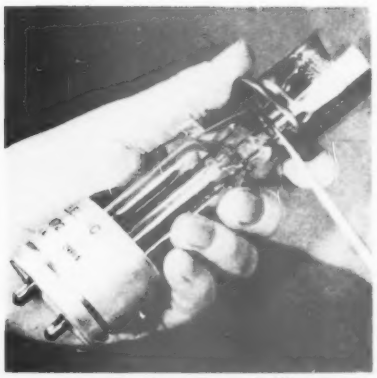
Table XI. Analysis of Respondents by Industries—Electrical Machinery

Electrical Machinery	Plants Surveyed	No. Plants Responding	Do Welding Number	Do Welding Percent	Do Not Weld Number	Do Not Weld Percent
Electrical generating, transmission, distribution and industrial apparatus	408	189	162	86	27	14
Electrical appliances	131	53	45	85	8	15
Insulated wire and cable	65	27	22	81	5	19
Electrical equipment for motor vehicles, aircraft and railway locomotives and cars	79	33	26	79	7	21
Electric lamps	46	16	13	81	3	19
Communication equipment and related products	334	137	107	78	30	22
Miscellaneous electrical products	97	44	40	91	4	9
Total	1,160	499	415	83	84	17

Table XII. Maintenance and Production Welding

Electrical Machinery	Maintenance Welding Total*	Arc	Gas	Resistance	Production Welding Total*	Arc	Gas	Resistance
Electrical generating, transmission, distribution and industrial apparatus	141	123	112	17	140	107	78	83
Electrical appliances	38	32	36	8	39	29	27	25
Insulated wire and cable	21	19	15	1	7	3	2	4
Electrical equipment for motor vehicles, aircraft and railway locomotives and cars	25	17	21	6	21	14	10	13
Electric lamps	13	7	12	1	8	2	2	7
Communication equipment and related products	94	68	76	11	80	38	37	67
Miscellaneous electrical products	37	31	37	7	20	13	9	11
Total	369	297	309	51	315	206	165	210

**The figures for arc, gas and resistance welding exceed the total because of duplication of types of welding within plants.*



Courtesy General Electric Co.

ELECTRONIC TUBE filament fabricated by resistance welding. Of lamp plants surveyed, 87½% use resistance welding for production

porting the use of welding—are using arc, gas and/or resistance welding and/or flame-cutting in producing the variety of products which might fall under the heading of non-electrical machinery. Arc welding is done in 88% of these 1,011 plants, gas welding and flame-cutting in 68% and resistance welding in 42%. Again the percentages total more than 100%, indicating the multiple use of welding processes. Multiple use is probably true of most of the plants surveyed, and is especially true of the construction and mining machinery group, which indicated a 98% use of welding among its responding plants. The 145 plants in this group reported a 90% use of welding for both maintenance (131 plants) and production (130 plants), the highest of the non-electrical machinery groups.

It is easy to see how a plant engaged in the manufacture of construction or mining machinery might employ advantageously all of the welding and some allied processes. For example, the manufacture of a crawler tractor, a concrete mixer or a coal loader would necessitate flame-cutting structural shapes and heavy plates to size and length. The next step might be to heat the flame-cut pieces with another oxyacetylene flame in order to straighten or form them. Finally, the pieces are welded to one another. The heavy structural members are arc welded, but lighter members may be gas or resistance welded. These "lighter" members need not be so light in weight either; several road machinery manufacturers are now spot welding two pieces of ⅜-in. plate on production lines. Some of the parts are then subjected to flame-treating processes such as flame-cleaning or flame-hardening.

The highest percentage to use arc welding for production (97%) was in the construction and mining machinery group; 126 of the 130 plants employing welding for production purposes reported themselves users of arc welding. Gas and resistance welding found their high production percentages among manufacturers of office and store machines and devices; 26 of 44 plants in this group are using gas welding in production (59%) while resistance welding is being used for production purposes by 32 of the 44 plants (73%).

Electrical Machinery

Manufacturers of electrical machinery indicated an 83% overall use of welding. This figure is based on 415 of the 499 plants who responded. Only 84 plants—17%—did not weld. Heaviest use is by the makers of miscellaneous electrical products, a category including everything from lighting fixtures to reducing machines. This group indicated a 91% use of welding. The low use was reported by communication equipment and related products, a group in which welding processes are used by only 78% of the plants. The other seven manufacturing groups covered by the general classification of electrical machinery ranged between these figures (Table XI).

As in the case of all of the other plants surveyed, the electrical machinery field indicated a predominant use of welding for maintenance applications (Table XII). A total of 89% of the plants responding reported maintenance welding application—369 of 415 plants. Most popular maintenance process is oxyacetylene welding and flame-cutting, which is being used in 84% of the plants doing maintenance welding—309 of 369 plants.

Arc welding, used in 297 plants, is three percentage points behind gas welding with 81%. Resistance welding in its many forms is being used for such applications as to repair guards, covers and other protective devices, etc., in 51 of the 369 plants reporting (14%).

Gas welding is employed for maintenance welding in many different types of plants, but only among the makers of electrical machinery is it found to be the favored process of the majority. Not only the majority but, in fact, all of the plants in the miscellaneous electrical products group reported the use of gas welding for maintenance. This group is thus one of the five 100% users of a welding process for maintenance purposes to be found in the 51 branches of the metals industry covered by The Welding Engineer survey.

Electrical Goods Production

On the production end, 76% of the 415 reporting plants (315) are using welding. Of these 315, 67% (210) are using resistance welding. The big use of resistance welding as a production process is for electric lamps, where it is found in 87½% of the plants; a close runner-up is communication equipment and related products, which reported an 84% production use of resistance welding.

Arc welding is found to be the major production process where the products of the industry are big and heavy—electrical generating, transmission, distribution and industrial apparatus. In this field, 77% of the reporting plants resort to arc welding. The overall production picture reveals that arc welding is used in 65% of the plants—206 out of 315 reporting plants.

Gas welding is used for production in 52% of the electrical machinery plants. It finds its heaviest use in electrical appliances, where it is employed by 69% of the plants doing production welding.

To simplify reporting, the machinery field has been separated into electrical and non-electrical machinery manufacture. The field must now be considered as a whole. Machinery makers represent an important segment of the welding market. It is estimated that there are 22,634 plants engaged in this work, of which 5,214 plants employ over 50 people each. The Welding Engineer survey reached 4,039 of these 5,214 plants and secured responses from 1,824 plants, or 45%, who indicated an 89% use of welding for either maintenance or production. The 1,624 plants doing welding had a total of 23,045 weldors in their employ.

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BY PHIL GLANZER

GAS WELDING mild steel at Veteran's Training Institute, Toronto, Canada

Training Weldors i

The need for properly trained weldors has always been admitted by those seriously concerned with advancement of welding, including the many weldors with ambition to become masters of their craft

TODAY the need for trained weldors is greater than ever before because of the larger field of application and the wider range of metals and alloys in use. Men who aspire to be weldors cannot hope to get by on flimsy knowledge. Neither can the "practical" weldor who has "just picked it up" hope to make real progress and be useful and happy at his chosen trade unless his expertness with torch and electrode is backed with the proper knowledge. True skill is a coördination of both mind and hands.

Welding Schools Necessary

These facts have long been recognized by industrial plants employing weldors and by manufacturers of welding equipment and products. Some of the most farsighted concerns have tried to meet the need by organizing their own welding schools. In Canada, for example, the Canadian Liquid Air Co. has operated welding schools for years for the benefit of customers and their weldors.

Single-company efforts must, of necessity, be limited in scope. They will not serve, and usually are not intended to serve, as a complete program of training covering all phases of welding. The time element alone in most cases precludes this.

It is obvious, then, that a weldor who wants to be master of his craft in the strictest sense of the term—for that matter any man who desires proper training to become a weldor—must acquire his knowledge to a large extent outside of industry. This is where technical and trades schools can fit into the program. For weldors already working at the craft or would-be weldors, accredited institutions of this type are virtually a necessity. Furthermore, the value of such schools is considerably enhanced when the welding students are taught in surroundings which approximate closely to an ideal welding shop in a truly modern industrial plant.

Model School at Toronto

Welding schools of this kind do more than provide comfortable working conditions for students; they set good patterns for laying out welding shops and help immeasurably in the

FLAME-CUTTING is taught, too. Students learn how to follow a template

PIPES ARE WELDED by the oxyacetylene process at special pedestal tables

in Canada

forming of efficient work habits, which will later benefit both the student and his employer.

A model school of this sort that is probably one of the most advanced and successful in North America has been operating in Toronto, Canada, for the past two years. This school is part of a remarkable educational project at the Veterans' Training and Reestablishment Institute. The project, under the direction of H. H. Kerr, started with about 55 students but has now over 2,000 regularly enrolled.

ARC WELDING is done in modern booths, each one brilliantly illuminated

Two welding courses are under the direction of H. W. Temple, who has the dual title of superintendent of training within industry and superintendent of trades training. These courses cover the entire field of practical oxyacetylene welding and cutting and arc welding and extend into forging, tool making and a study of metals. One course is of six months' duration, the other eight months—the latter including the forging instruction. The eight months' course is particularly valuable to weldors who wish to seek supervisory posts in industry or to go into business for themselves.

These courses are directly supervised by Harold Howard, chief instructor in charge of the welding school. Mr. Howard is assisted by three other instructors: F. Williams, L. E. Vance and V. Yarkie. These welding experts have among them abilities and experiences that enable them to perform as a smooth, well informed instructional team. One was formerly an instructor in aircraft welding, a second in the navy and the third taught in army trade schools. As for Mr. Howard, the Chief, he was employed in war emergency training work.

Who Takes the Courses?

The majority of students are young veterans who are taking the courses for various reasons. Some of them have already been exposed to welding in industry or the various armed services and have liked the seeming prestige enjoyed by weldors. Some are expert mechanics desirous of adding welding to their other abilities; these men usually look upon the course as a stepping stone to supervisory positions in industry. Still others plan to go into business for themselves. Then there are storekeepers, truck drivers, clerks, salesmen, etc., who have decided to make welding their new vocation.

All students are carefully interviewed before being admitted to the course in order to ascertain their real aptitudes for the work. That the precaution is of true value to the student

BLACKSMITHING is popular. The student learns the feel and color of hot metals by work on the anvil

is borne out by the records, which show that more than 90% of the school's graduates make good. The course itself is designed to establish whether the student has an aptitude for welding or not. If he has not, the fact shows itself very early, and the student is guided into work for which he is better suited. Service to the student is the unwritten law of the institution.

When a new student enters the welding school for the first time, he cannot help but feel the industrial atmosphere which makes this school unique. For all practical purposes he can imagine himself to be actually employed in the welding shop of a modern industrial plant.

The chief instructor, Mr. Howard, confides that he had planned such a shop for 12 years. He had always felt that there was a great need for efficient layout in a welding shop, and here was the opportunity to put his ideas into practice. Consequently, the welding shop is something of a craftsman's dream, but a very practical one.

Pedestal Welding Tables

Design of the majority of the gas-welding tables, for example, might well be copied profitably. This table has a square top with a central support and a round flat base. The single central pedestal allows the weldor to get all around the work without much effort and also permits the floor to be kept clean. Each table is fitted with a handy fixture made of pipe, which can be adjusted in any position for holding the work.

Provisions for arc welding are just as thoroughly organized. Six booths occupy one side of the room, with entrances against the wall. Each booth is fitted with the necessary table and with a light directed down from the right-hand corner. The light makes it easier for the weldor to see where he is starting the arc and insures shadowless illumination when the weldor is setting up or examining his work.

The controls for each welding machine are on the wall behind the booths, but the welders themselves are in a special room at the back. This practice eliminates unnecessary noise and keeps the floor around the booths from being cluttered with cables. The machines are also fully protected.

Positions of tables, booths, tools and test equipment have all been carefully thought out to insure the highest possible efficiency. Nothing has been overlooked to provide ideal working conditions and to set examples that students can carry away in their minds for translation into practical terms in industry. The entire layout of the school is designed to demonstrate the possibilities and value of the well organized shop.

Students Did the Work

Mr. Howard suggests that a little ingenuity, resourcefulness and enthusiasm for one's job will suffice to turn many welding shops which today are ill designed, cluttered and inefficient producers into model shops at moderate cost. All that the Toronto school had to start with was a bare room and a box of equipment. But the enthusiastic instructors were able to enlist the help of the students, who turned the place into a model workshop while learning their trade at the same time. Welding was used in every way possible in the building of equipment, fixtures, tools, etc.

The school's equipment includes: hand-cutting torches, gas welding torches, flame-cutting machines and a-c and d-c arc welders. There are also radial and pedestal drills, a set of rolls, a multi-shear for light materials and the usual equipment for pulling and bending tests. Many of these tools were built wholly or in part by welding and cutting.

Proper respect for tools is inculcated in students at every opportunity. The tool cupboard is a model of its kind. Brass tallies stamped with students' numbers are hung on the inside of the door. When a tool is borrowed, the student hangs his tally above the empty space in the tool rack. The instructor has only to read the number to know who has the tool.

When he joins the class, each student is given a personal tool box containing welding goggles, grinding goggles, gloves and a welding helmet. Every Monday morning he receives a clean suit of overalls. Damages to or loss of equipment are only charged against him if wilfully perpetrated.

While welding is the primary interest of the students, the majority of them enjoy the sessions on forging and heat treating. Their confidence soars with each new fact acquired about the reaction of metal under heat. They learn to respect the forces of expansion and contraction and are elated to discover that they can use these ordinarily troublesome forces to aid them in welding.

Learn on the Anvil

These modern blacksmiths find the hammer and anvil extremely useful around a shop. As one instructor so aptly put it, "There is no better place to learn to use the hand tools usually found in a steel shop than at the anvil." These pieces of equipment are therefore used regularly by the students in making their own chisels, chipping hammers, tongs, etc. They are taught to shape, to draw and to heat treat. In this way they get to know what happens to steel and iron under heat and when quenched, learn to estimate approximate temperatures by the colors of hot metal. This phase of the course is very popular. As the students gain in experience, their ability with the hammer and anvil becomes truly astonishing.

At the time of the present writing, the students had nearly completed large sections of ornamental railing and two attractive gates for the school grounds. Gates and railings were made from hot-rolled stock, forged and welded together with hammered shapes intertwining in the design. Ornamental sections for the gates were flame-cut from steel plate with the shape-cutting machine. Gates and railings were to be installed in connection with brick pillars and walls, erected by the bricklaying students of the Institute.

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Oxy-Acetylene	"41" Nickel Gas Welding Wire	For welding of pure Nickel—no flux required
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Submerged Melt	"51" Nickel Wire	For welding pure Nickel
Inert Gas Metal-Arc	"61" Nickel Wire	For welding pure Nickel

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Oxy-Acetylene	"42" Inconel Gas Welding Wire	For welding Inconel* using INCO "2" Gas Welding Flux
Metal-Arc	"132" Inconel Welding Electrode A.C.-D.C.	For welding Inconel; and Inconel to steel
Submerged Melt	"52" Inconel Wire	For welding Inconel
Inert Gas Metal-Arc	"62" Inconel Wire	For welding Inconel

70/30 COPPER-NICKEL

Oxy-Acetylene	"47" 70/30 Copper-Nickel Gas Welding Wire	For welding 70/30 Copper-Nickel using INCO "1" Gas Welding and Brazing Flux
Metal-Arc	"137" 70/30 Copper-Nickel Welding Electrode D.C.	For welding 70/30 Copper-Nickel
Submerged Melt	"57" 70/30 Copper-Nickel Wire	For welding 70/30 Copper-Nickel

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Oxy-Acetylene	"44" "K" Monel Gas Welding Wire	For welding "K"* Monel, using 2 parts INCO "2" Gas Welding Flux and 1 part Lithium Fluoride
Metal-Arc	"134" "K" Monel Welding Electrode D.C.	For welding "K" Monel
Inert Gas Metal-Arc	"64" "K" Monel Wire	For welding "K" Monel

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Metal-Arc	"130X" Monel Welding Electrode D.C.	For welding Monel side only

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Metal-Arc	"133" 80/20 Nickel-Chromium Welding Electrode A.C.-D.C.	For welding Inconel side only; and solid Inconel to steel

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For further information, write for your copy of the catalogue: "INCO Welding Materials."

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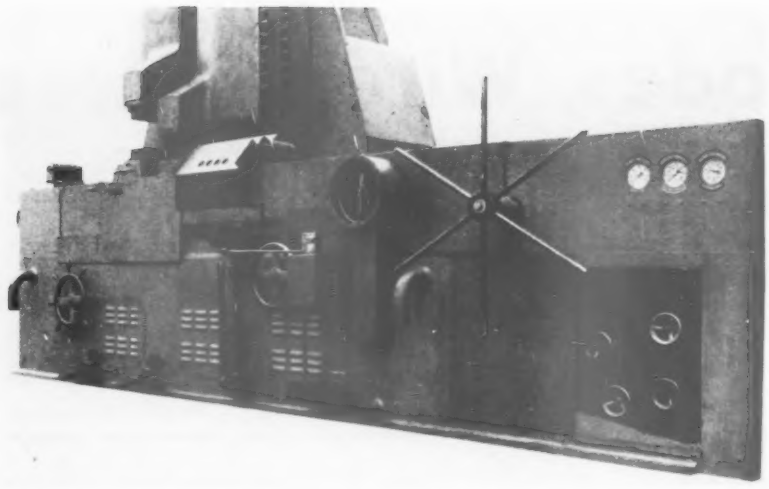

PRAGA FLASH WELDER, produced in Czechoslovakia, has a single-phase welding transformer that transmits a welding current of 60,000 amperes

WELDING "CLOCK" at right indicates movement of the die support

BIG WELDERS in Czechoslovakia

BY BETH FISHER
McGraw-Hill World News

Ceskomoravske-Kolben-Danek, Prague, the second largest metal working concern in Czechoslovakia, is producing some interesting resistance welders. One is a flash welder with maximum output of 600 kva

FIRM of Ceskomoravske-Kolben-Danek (CKD) is the second largest metal-working plant in Czechoslovakia, being exceeded in size only by Skoda at Pilsen. Like Skoda, CKD is a huge combine, having five electrical engineering works at Prague alone. Its manufactures include power stations, complete factory equipment, metallurgical plants, bridges, mine equipment, autos, planes and locomotives.

BIG FLASH WELDER

The semiautomatic flash-welding machine "Praga" developed by CKD is the largest of its kind ever made in Czechoslovakia and probably in Europe. This heavy machine is used for welding large steel forgings and machine parts, for example, locomotive side frames, rails, etc. Basically, it consists of a single-phase transformer with a nominal output of 300 kva and a maximum of 600 kva. The secondary winding and other parts of the machine designed for transmitting the maximum welding current of 60,000 amp are water-cooled.

Two clamping devices fasten the workpieces by hydraulic forces controlled by foot valves. The welding process comprises three main operations: preheating, fusing and setting up. A very sensitive, hand-operated hydraulic valve provides exact control of right and left hand movements of the die support during the preheating or flashing period. Upsetting follows automatically.

A three-phase motor located inside the machine drives the hydraulic pump. The oil pressure can be regulated up to 115 atmospheres (1,640 psi) so as to obtain clamping and setting-up forces of 50,000 and 32,000 lb respectively.

An important part of the installation is the control device of the secondary current. There is a ten-stage commutator connected to ten tappings of the primary transformer winding. The weldor is able to regulate exactly the distance of the two clamping devices from each other by means of a hand wheel driving a worm gear and screw. Switching operations and the drive of the hydraulic pump are controlled by push buttons and electromagnetic contactors.

The whole course of the welding process can be followed by observing the two pointers of the welding clock, movement of which depends on that of the die support and upsetting stop. Another controlling device is a preheating clock, control lights of which indicate the moment the right temperature for fusion is reached. These "clocks" make it easy to attend and control the machine, insuring reliability.

In continuous work, the machine can make three welds an hour in steel with a section of 15,000 sq mm (23.25 sq in.). One weld an hour will be made if the piece has a maximum welding area of 20,000 sq mm (31.00 sq in.).

SPOT WELDER

Another important machine being manufactured by Ceskomoravske-

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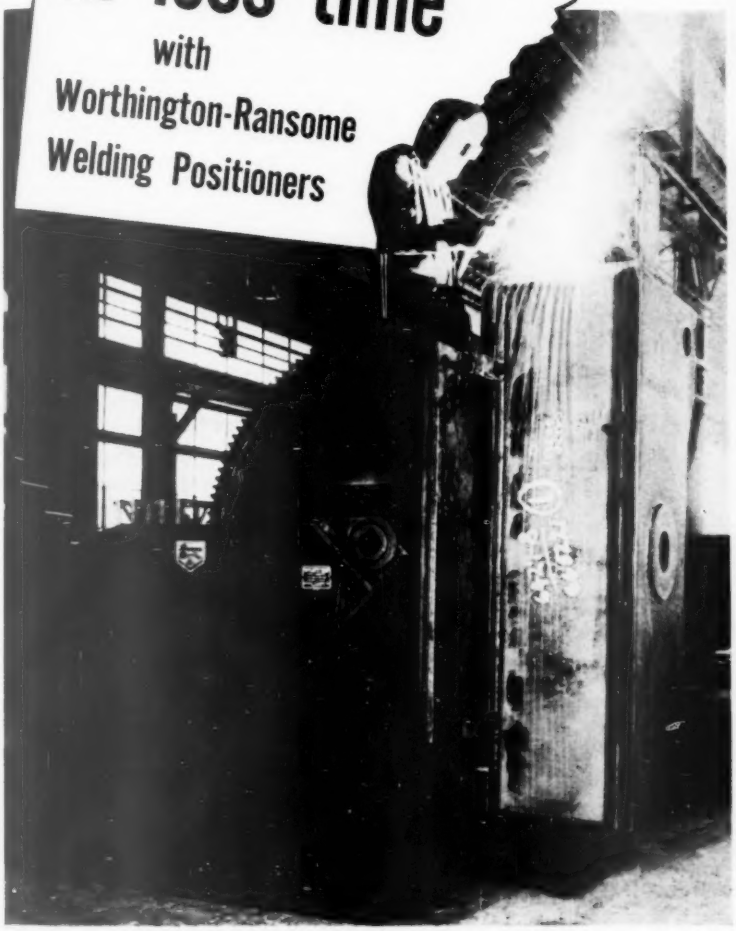
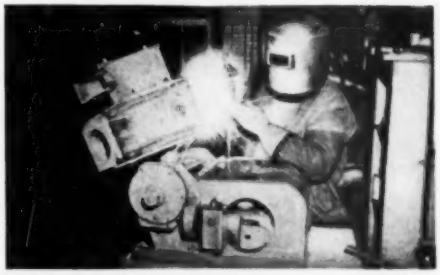
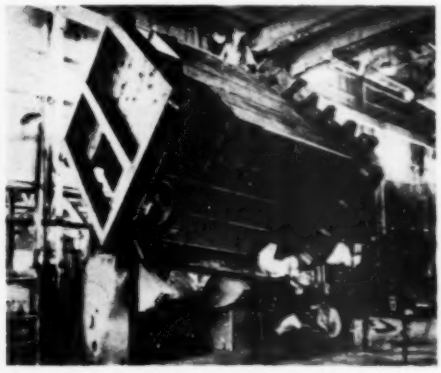


Model 240: 12-ton Worthington-Ransome Welding Positioner

Model 5: 500 lb Worthington-Ransome Welding Positioner



Model 1P: 100 lb Worthington-Ransome Welding Positioner



Model 7: 20-ton Worthington-Ransome Welding Positioner

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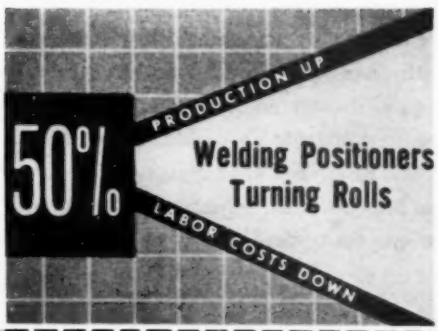

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Kolben-Danek is the Praga electric joint welding machine for both "single-point" (spot) welding and automatic series welding of steel sheets. By a suitable adaptation of the lower arm, it is also possible to weld steel bolts to thick iron tubes.

The single-phase transformer of this machine has a nominal output of 270 kva and a maximum of 450 kva. Water cooling is provided for both primary and secondary windings. Upper arm of the machine carries a hydraulic cylinder, piston of which moves the upper electrode. The lower arm can be adequately adjusted to obtain the desired throat opening.

Pressure is obtained by compressed air (84 psi) admitted to the cylinder by electrically controlled valves. A special regulating device, including pressure gauges, permits the modifying of mutual pressure of the electrodes within wide limits.

All welding operations such as controlling the movement of the electrodes, switching in the network current, the welding current, regulating the welding pressure, etc., are controlled by push buttons and electromagnetic contactors.

A characteristic of this machine is that it can be used for program welding, which means that each welding cycle comprises the following phases: (1) preheating by low-voltage current; (2) welding with or without pressure modification according to the determined pressure curve; (3) annealing by low-voltage current; (4) high-pressure forging without electric current. All these operations can be combined by a push-button adjustment beforehand. Time taken by different operations can be controlled independently by time relays within the limits of from 0.2 to 5 seconds. Program welding is mainly used for thick steel sheets destined for heavy constructions and for alloy steel.

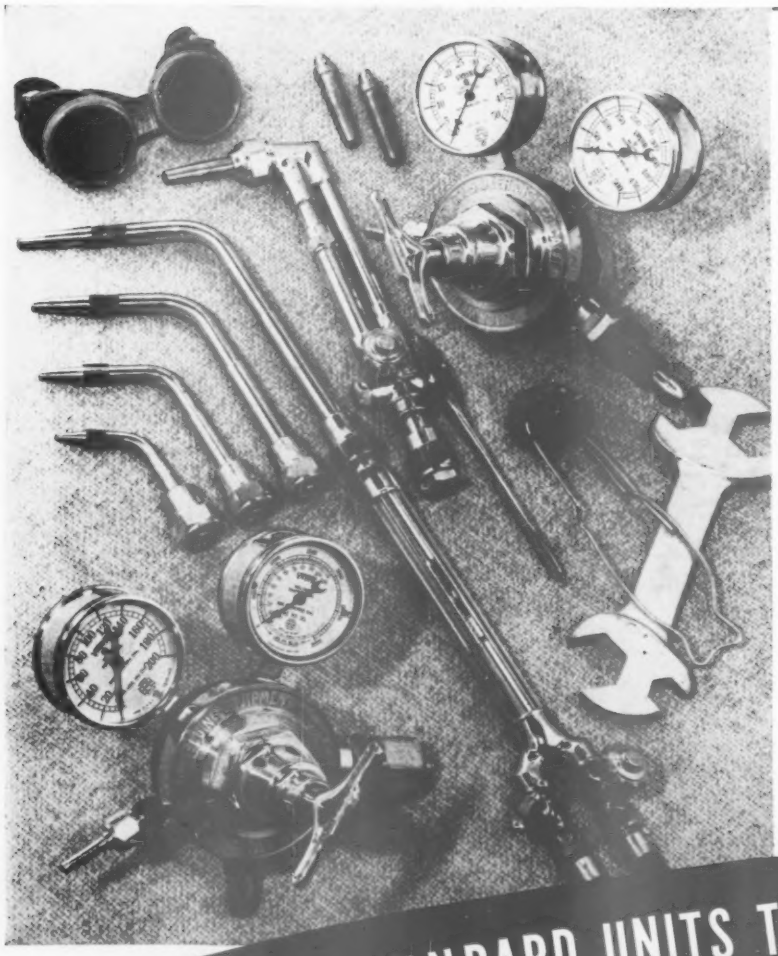
With automatic, continuously regulated welding, the number of spot welds is about ten a minute. Steel sheets up to 2 to 10 mm (0.079 to 0.394 in.) can be welded in continuous work, and steel sheets up to 2 to 14 mm (0.550 in.) can be welded in interrupted work. Steel pins of diameters from 12.5 to 42 mm (0.486 to 1.65 in.) can be welded to tubes up to 33 mm (3.27 in.) in diameter at the rate of 500 pieces an hour.

TYPICAL CHARACTERISTICS OF MAGNESIUM ALLOYS

	Alloy No.			Nominal Composition (Mg = Remainder)			Heat Treatment†	Specific Gravity (75 F)	Weight, Lb./Cu. In.	Melting Point, F	Tension					Compression M Psi.		Shear M Psi.	Brinell	Rockwell E	Fatigue M Psi.	Impact Izod Ft./Lb.	Resistance to Salt Water, A = Best	Relative Cost A = Lowest	Color Code AS = Aluminum Stripe
											Ultimate Strength M Psi.		Yield Strength M Psi.		% Elong. in 2 In.									
	ASTM	DOW	AMC	Al	Zn	Mn					Typ.	Min.	Typ.	Min.	Typ.	Min.	Ult. Str.	Y'd. Str.						
Sheet	AZ31X	FS-1a	C52S-O	3.0	1.0	0.3	a	1.77	0.064	1160	37	32	22	—	21	12	—	16	21	56	67	12	—	B	B	Red-AS
		FS-1h	C52S-H	3.0	1.0	0.3	h	1.77	0.064	1160	43	38	33	26	11	4	—	26	23	73	83	14	—	B	B	Red-AS
	AZ31X	JS-1a	C54S-O	5.0	1.0	0.2	a	1.79	0.065	1150	40	—	23	—	18	—	—	15	20	59	71	14	—	A	D	Brown-AS
		JS-1h	C54S-H	5.0	1.0	0.2	h	1.79	0.065	1150	47	—	34	—	10	—	—	30	21	72	82	16.5	—	A	D	Brown-AS
	M1	Ma	3S-O	—	—	1.5	a	1.76	0.064	1200	33	28	15	—	17	12	—	12	17	48	55	9	—	C	A	Yellow
		Mh	3S-H	—	—	1.5	h	1.76	0.064	1200	37	32	29	22	8	4	—	20	17	56	67	10	—	C	A	Yellow
Bars	AZ31X	FS-1	C52S	3.0	1.0	0.3	—	1.77	0.064	1160	40	35	30	22	15	10	60	17	19	49	57	14	—	A	B	Red-AS
	AZ61X	J-1	C57S	6.5	1.0	0.2	—	1.80	0.065	1145	45	40	32	26	15	11	—	20	—	58	70	18	—	A	C	Gray-AS
	AZ80X	O-1	C58S	8.5	0.5	0.2	—	1.80	0.065	1130	49	43	33	25	11	9	—	22	—	55	77	19	—	A	D	White-AS
	M1	M	3S	—	—	1.5	—	1.76	0.064	1200	38	30	26	20	10	3	—	14	—	42	41	9	—	B	A	Yellow
Shapes	AZ31X	FS-1	C52S	3.0	1.0	0.3	—	1.77	0.064	1160	38	33	26	20	14	8	—	15	—	50	59	—	—	A	B	Red-AS
	AZ61X	J-1	C57S	6.5	1.0	0.2	—	1.80	0.065	1145	44	40	28	22	16	9	—	19	—	64	76	—	—	A	C	Gray-AS
	AZ80X	O-1	C58S	8.5	0.5	0.2	—	1.80	0.065	1130	46	41	29	25	9	6	—	22	—	67	78	—	—	A	D	White-AS
	M1	M	3S	—	—	1.5	—	1.76	0.064	1200	34	29	20	17	9	3	—	11	—	46	50	—	—	B	A	Yellow
Tubing	AZ31X	FS-1	C52S	3.0	1.0	0.3	—	1.77	0.064	1160	36	32	21	16	16	8	—	15	—	46	51	—	—	A	B	Red-AS
	AZ61X	J-1	C57S	6.5	1.0	0.2	—	1.80	0.065	1145	40	36	21	16	14	7	—	15	—	50	60	—	—	A	C	Gray-AS
	M1	M	3S	—	—	1.5	—	1.76	0.064	1200	33	28	21	—	9	3	—	10	—	42	41	—	—	B	A	Yellow
Castings	A10	G	240	10.0	—	0.1	AC	1.81	0.066	1100	22	18	13	10	2	1	48	13	17	54	65	10	2	D	A	Purple
				10.0	—	0.1	HT	1.81	0.066	1100	33	29	12	10	8	5	50	12	19	52	62	12	4	D	B	Purple
				10.0	—	0.1	HTA	1.81	0.066	1100	34	29	19	17	2	—	54	19	21	69	80	10	2	D	C	Purple
	AZ63	H	265	6.0	3.0	0.2	AC	1.83	0.066	1155	29	24	14	10	6	4	45	14	18	50	59	11	3	C	A	Green
				6.0	3.0	0.2	ACS	1.83	0.066	1135	29	24	14	10	5	2	—	—	—	—	—	11	—	C	B	Green
				6.0	3.0	0.2	HT	1.83	0.066	1135	40	34	14	10	12	7	46	14	19	55	66	14	5	C	B	Green
				6.0	3.0	0.2	HTA	1.83	0.066	1155	40	34	19	16	5	3	50	19	20	73	83	13	2	C	C	Green
				6.0	3.0	0.2	HTS	1.83	0.066	1135	40	34	17	13	7	4	—	—	—	59	71	13	—	C	C	Green
	AZ92	C	260	9.0	2.0	0.1	AC	1.82	0.066	1110	24	20	14	10	2	1	55	16	18	65	77	11	1	C	A	Orange
				9.0	2.0	0.1	ACS	1.82	0.066	1110	24	20	14	11	2	—	—	—	—	—	—	11	—	C	B	Orange
				9.0	2.0	0.1	HT	1.82	0.066	1110	40	34	16	10	10	6	60	16	20	63	75	14	4	C	B	Orange
				9.0	2.0	0.1	HTA	1.82	0.066	1110	40	34	23	18	2	1	70	23	21	84	90	13	1	C	C	Orange
				9.0	2.0	0.1	HTS	1.82	0.066	1110	40	34	20	16	3	1	—	—	—	75	83	13	—	C	C	Orange
	M1	M	403	—	—	1.5	AC	1.76	0.064	1200	14	12	4.5	—	5	3	27	4.5	11	33	3	—	9	B	B	Yellow
	AZ90	R	263	9.0	0.7	0.2	—	1.81	0.063	1120	33	—	22	—	3	—	58	22	20	60	72	14	2	A	B	Blue

Modulus of Elasticity—6,500,000 psi. • Coefficient of Thermal Expansion—0.000016 inch per inch per degree F (65 to 750 F).

NOTES: † Heat treatment: AC = as cast, HT = solution heat-treated, HTA = heat treated and aged, S (ACS and HTS) = stabilized, a = annealed, h = hard rolled.



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Even in cases where only a few welding machines are used, the switch from d-c to a-c promises substantial savings in power, in wages and in maintenance.

Savings in power—because a-c welding requires one-third less power, giving 85% to 90% efficiency as against 55% to 65% for d-c machines.

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Savings in maintenance—because a-c welders have no rotating parts. There are no brushes to replace . . . no commutators to clean or machine . . . no need for frequent greasing. But this is only part of the story. For the complete information on the savings opportunity this adjusted electrode price offers, send for Booklet B-4199. Address Westinghouse Electric Corporation, P. O. Box 2025, Buffalo 5, New York. J-21520

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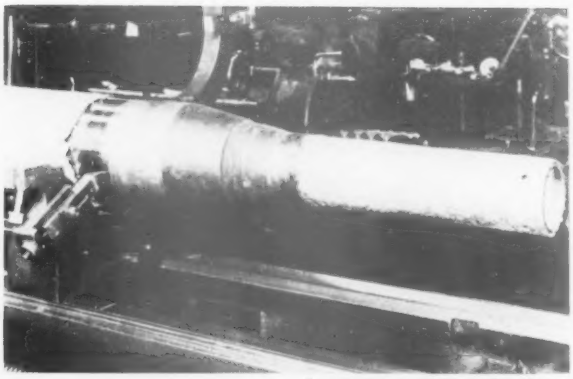
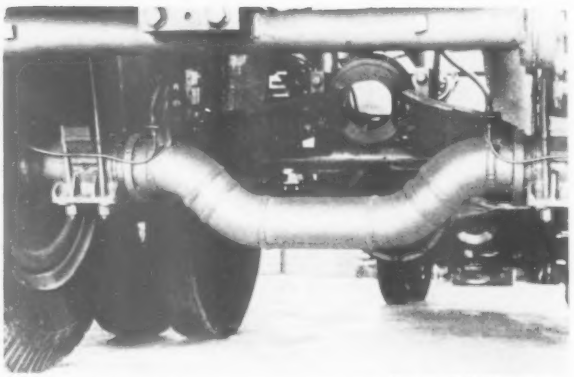


Courtesy Eutectic Welding Alloys Corp.

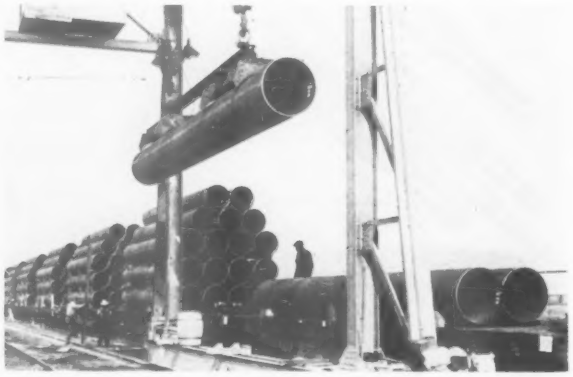
WARPED BY HEAT TREATMENT, this huge glass manufacturing roll was saved by overlaying end shafts with low-temperature bronze alloy



Courtesy Tube Turns, Inc.

DROP-CENTER AXLE for Eisenhauer "Freighter" can take it. It's fabricated from heavy 4-in., 45-deg welding elbows and 4-in. pipe

WELDING RIM to centerplate to fabricate blank for a 7½-ton bull gear. The big wheel turns slowly under a submerged-melt welding head



MAGNETIC HOIST loads first shipment of 30-in. welded pipe fabricated by Consolidated Western for a gas line from Texas to New York

Marine Bull Gear Welded

A 7½-TON gear for a large marine ore carrier was recently fabricated by automatic welding at the Sunnyvale, Calif., Works of Westinghouse Electric Corp. The big "bull gear" is one of the two similar gears that represent the final stage of a series of gears for speed reduction. The full load of the 7,000-hp turbine propulsion unit is taken at 6,000 rpm and reduced to 100 rpm for the propeller shaft.

Two kinds of steel went into the big bull gear. Its hub, centerplates and ribs are made of mild or medium-carbon steel; the rim—later hobbed into 693 helical teeth—of high-carbon steel. First step in the fabrication was to weld the hub to the centerplates that form the sides of the gear blank. The large wheel was slowly rotated under a submerged-melt welding head while welding wire and flux were fed automatically.

Next step, shown in the picture at bottom left, was to weld the high-carbon-steel rim to the centerplates. The worker at the right of the picture keeps a constant check on the adjustment of the welding wire and its rate of feed. His companion on the left is removing excess flux with a suction hose. Hidden by the welding head are the torches that kept the rim heated during the weld.

* * *

Pipe for "World's Longest"

A 100-CAR train loaded with a shipment of 30-in. welded pipe left Los Angeles recently to become part of the world's longest pipe line. The pipe, fabricated by Consolidated Western Steel Corp., is consigned to Transcontinental Gas Pipe Line Corp., which will build the 1,840-mile line connecting New York City with Texas and Louisiana gas fields.

Pipe in the initial shipment will stretch about 10 miles. Nearly 200 such shipments will have to be made and more than 470,000 tons of steel will be needed to complete the $190,000,000 project.

The line, planned for completion early in 1951, is designed to deliver a maximum of 340,000,000 cu ft of natural gas per day. Capacity can be increased to 505,000,000 cu ft daily by increasing the number of compressor stations and the compressor capacity in the ten stations currently being built.

Welding Fittings Make an Axle

AFTER extensive research and gruelling tests, a new motor truck has made its debut on America's highways. It's the 10-wheel Eisenhauer "Freighter," which has multiple axles that lend themselves to a closely co-ordinated system of suspension.

The middle one of the three rear axles is of drop-center design and posed an interesting problem in manufacture. To forge the axle from tubular steel, as was at first planned, would have meant a considerable investment in dies and special fixtures with resulting irksome delays. But Eisenhauer's alert engineers found a better way in the use of welding and welding fittings. Their method is to fabricate the axle of 4-in. extra-heavy 45-deg elbows and 4-in. extra-heavy pipe. The welded axle is produced at lower cost and has the strength and stamina to withstand the severest road shocks.

The new truck also has twin engines, which give it impressive advantages.

* * *

Salvage $15,000 Roll

AFTER $15,000 had been spent in its manufacture, a 20-ft-long precision-

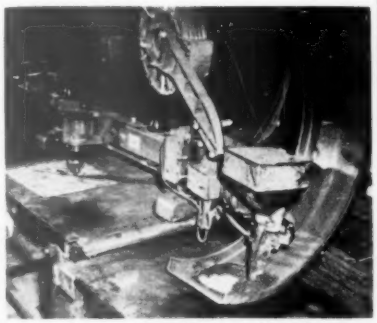
ground roll for glass making warped during heat treatment until its machined ends were no longer concentric. To salvage its heavy investment, the glass company decided to try to build up the warped end shafts.

First step was to apply a slight preheat to the entire area, working the torch all the way around to prevent overheating. The overlay was then deposited by the oxyacetylene process, using a new flux-coated bronze welding rod in the 3/16-in. size. This patented alloy bonds at 1,000-1,200 F and is claimed to be two or three times harder than other bronze deposits; it work hardens from Brinell 180 to Brinell 235.

About 39 lb of bronze alloy were deposited. The welding process was alternated from one end to the other while an air hose played on the polished roll to keep it from overheating. The job was done in 7½ hours and the roll machined down to final size in another 6 hours—13½ hours to save a $15,000 investment.

The roll is made of Nichrome steel with 1020 steel welded on the ends.

* * *



Courtesy The Linde Air Products Co.

SHAPE-FOLLOWING carriage and submerged-melt welding head make circular weld on a curved radiator shell in 40 seconds

Welds on Curved Surface

IN ORDER to join the collar of the smoke pipe to the radiator shell of a hot-air furnace, a midwestern manufacturer had to make a circular weld on a curved surface. He found that the 10-in.-diameter weld could be made in approximately 40 seconds by attaching a submerged-melt welding head to the arm of a shape-following carriage.

As the picture shows, an adjustable radius bar guides the tracing head in a circle of the proper diameter. Since the weld lies on the curved surface of the larger piece, there will be a continual change in the vertical distance between electrode and work. Arc length is kept constant by an electronic voltage control, which regulates the rate of rod feed in order to compensate for change in the vertical distance.

In the background of the picture is an oval template that is used for shape-welding another part of the furnace. It takes only a few minutes to remove the radius bar and change the tracing head to follow a strip template. Use of a shape-following carriage makes it possible to employ the submerged-melt process in practically any desired outline of weld.

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The Tool All Welders are Talking About!
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Simply place the jaws over the parts to be welded —and close the toggle lever. This LOCKS the jaws to the work with powerful grip. The parts are held in alignment, securely—freeing both hands for handling the welding equipment. U-shaped jaws provide excellent visibility and working space for welding. Jaws adjust to 1⅝". Made by makers of the famous VISE-GRIP Wrench.
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Courtesy Air Reduction Sales Co.

LOW-HYDROGEN electrode welds high-carbon steel mower blades to mild-steel discs

High-Carbon to Mild Steel

WORTHINGTON Mower Co., Stroudsburg, Pa., is using a new low-hydrogen type of electrode to weld high-carbon steel mower blades to mild-steel discs. Use of this electrode, which operates on either a-c or d-c and gives deposits of up to 100,000 psi tensile strength, is said to cut down rejects due to weld cracking by 50 to 60%.

* * *

Flame-Cutting Stainless

FABRICATION of a Diesel water tank of 18-8 stainless steel involved the cutting of two 10 by 18 in. holes in the 10-gauge material, one on each side of the tank. A recessed section for water and air connections was to be welded into these holes.

The two holes were cut quickly and accurately in the curved sides of the tank by means of a powder-cutting process. An iron-rich powder is added automatically to the cutting oxygen, releasing large quantities of heat. The burning of the iron powder permits the cutting oxygen to oxidize the base metal, which is refractory to the ordinary oxyacetylene flame. The cuts were said to compare favorably in quality with flame-cut carbon steel.

Cutting oxygen was at a pressure of 75 psi and acetylene at 10 psi in this particular operation. Compressed air at 18 psi forced the powder into the oxygen stream. The rate of cutting was 12 ipm.

Courtesy The Linde Air Products Co.

POWDER CUTTING was employed to cut two 10 by 18 in. holes in stainless-steel tank

the fixture (see Fig. 4, page 37).

A reinforcing bead is laid along the outer face of the frame, which face is horizontal at the time welding is done. A round filler rod of the same aluminum alloy as the extrusion is used. Again, no flux is needed because the arc is shielded with inert gas. When this part of the weld has been completed, the frame is removed from under the clamp and is laid flat, without clamping, on top of the fixture (see Fig. 5). Now the V-groove is uppermost. As the ends cannot separate because of the prior weld, no means for holding or locating are required. A bead is laid in the vee to complete the joint.

They're Treated Rough

Experience has shown that joints welded in this manner are stronger than the frame at any other point. Hence no special provision for testing is made. Occasionally, the foreman takes a welded frame selected at random and throws it on the concrete floor so that the corner next to the weld strikes the floor hard enough to bend the frame. This stresses the weld severely, but breakage does not occur. The bend comes at some other point than the weld, indicating that the welded section is stronger than other sections.

The beads are on the outside of the frame and do not affect any fit; their appearance is of little importance, and no special effort is made to hold any particular shape of bead. Neither are finishing operations required; the gas-deposited surfaces are smooth because no spatter occurs in gas-shielded arc welding. Since the weld has ample strength as produced, it is not necessary to heat treat it.

This welding operation is likewise performed by a girl, who also puts the frames into and removes them from the fixture. About 285 pieces, each involving two separate welds, are completed in an eight-hour day.

The results obtained with gas-shielded equipment have been so satisfactory in our plant that this type of welding will be extended to other parts that can be adapted to it.

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Resistance welding is at its highest development, from a time and cost saving standpoint, in some of the elaborate setups used in the automotive industry. For welding equipment alone, investments of several million dollars are commonplace, and months are spent in planning and development.

Weiger-Weed engineers are called in frequently to contribute ideas, to make cost saving suggestions, and to supply electrodes, dies, seam welding wheels and other current-carrying parts. That is why the Weiger-Weed plant is located in the center of the automotive industry.

This consultation service regularly used by mass-production experts is available to the smallest user of resistance welding, and at the same cost—that is, no cost at all. Weiger Weed & Company, Division of Fansteel Metallurgical Corporation, 11644 Cloverdale Avenue, Detroit 4, Michigan.

This book contains latest information on resistance welding—with description and illustrations of Weiger-Weed complete line. Send for your copy gratis.

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Resistance Welding ELECTRODES
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New Products to Use

"TOUCH-START" control used with modified torch in new h-f inert gas arc welder

Tuned Torch for Inert Arc

REGARDLESS of working or weather conditions, the "Gasarc" high frequency welder for inert-gas arc welding will remain on its assigned frequency of 27,120 kc. It causes no communications interference by either fundamental or harmonic radiation and hence has been approved by the Federal Communications Commission (page 82).

The "Gasarc" oscillator is a full wave, self-rectifying single-tube type. It is self contained with a few component parts and may be used on other welders.

The new "Gasarc" torch is "tuned" to preserve freedom from interference while transferring high frequency energy from the oscillator to the welding arc. "Missed" cycles, common to spark gap oscillators, are eliminated, and the need for frequent gap adjustment is avoided.

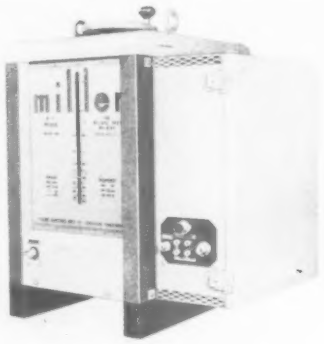
A new arc starting procedure called "touch start control" insures accurately placed welds and does away with sticking of electrodes. With his helmet raised, the welder contacts the electrode with the work at the precise start of the joint. Touching the electrode to the work energizes a control circuit which turns on the h-f current. After lowering his helmet, the operator withdraws the electrode, which automatically turns on the welding current. Both currents are shut off automatically when the arc is broken.

The new oscillator unit will be an integral part of NCG's "Sureweld Gasarc" inert arc welders, to be made in six models ranging from 150 to 750 amp capacity. THE NATIONAL CYLINDER GAS Co., 840 North Michigan Ave., Chicago 11.

* * *

Bronze Welding Rod

OVERLAYING shafts, building up gear teeth, salvaging molds and forms are some of the applications of Eutectic "Bronzochrom 185FC," a new flux-coated bronze welding rod that bonds at 1,000-1,200 F. It is said to produce a tough, machinable deposit that is corrosion-resistant and has a tensile strength of 80,000 psi. Other properties are a low frictional coefficient and a Brinell hardness of 180, which work-hardens to 235 or more. This alloy is claimed to bond to iron, steel, stainless, copper, nickel and Monel. EUTECTIC WELDING ALLOYS CORP., 40 Worth St., New York 13.



PNEUMATIC timer for inert-arc spot welding is included on Miller welder-timer

Inert-Gas Spot Control

MILLER 264-T welder-timer assembly for "Heliarc" spot welding includes a pneumatic timer, solenoid gas valve and flow meter. The pneumatic timer is said to have the accuracy of electronic timers but requires less servicing. Three models of pneumatic timers are available for varying installations. The welder has a current range of 50 to 335 amp and includes a built-in high-frequency unit. Power-factor correction is available as optional equipment. THE MILLER ELECTRIC MFG. CO., Appleton, Wis.

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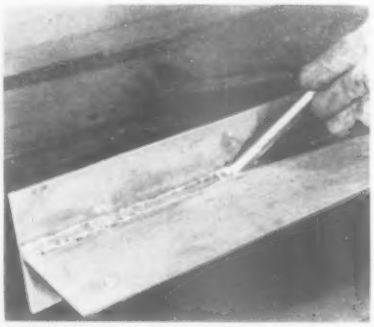

RUBBED-ON reheated weld, regalvanizing alloy bonds to base metal. No flux needed

Regalvanizing Alloy

GALVANIZED surfaces may be restored to welded structures and sheets by a zinc base alloy called "Galv-Weld." This product requires no flux, melts at 450 F and bonds with the base metal upon application to a heated surface. "Galv-Weld" comes in sticks made in two sizes: ¼ by ¼ by 13 in. and ⅜ by ⅜ by 13 in. Before applying it, the slag must be brushed off and the weld reheated with a torch to approximately 600 F. Hot-dip regalvanizing after welded assembly is said to be largely eliminated by this process. U. S STEEL SUPPLY CO., 208 South LaSalle St., Chicago 4.

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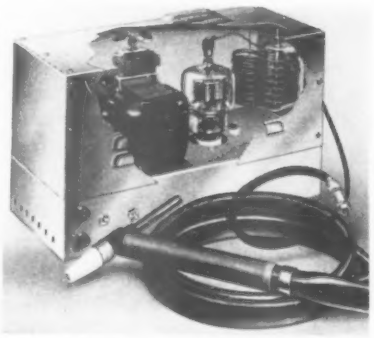

SINGLE-TUBE oscillator keeps G-R welder operating at 27,120 kc h-f current

Stable Frequency H-F Welder

Spurious and harmonic radiation of high frequency energy is reduced to levels permitted by the FCC and a stable frequency of 27,120 kc per second is maintained in the new G-R "IGT" inert-gas arc welders. The welder is used with a specially modified torch.

Stable frequency is maintained by a single-tube oscillator of the full-wave self-rectifying type. The entire h-f circuit operates at ground potential; maximum voltage at the torch is only 20 v. No "feedback" of h-f into the welder occurs, protecting it against insulation breakdowns.

A "touch start" control provides automatic cold starting when the electrode contacts the work piece. A 6-volt control circuit turns on the h-f current, after which the welding current comes on. Both h-f and welding current are automatically shut off when the arc is broken. Manual controls on the welder are simple, consisting of a current regulator handwheel and an on-off switch for the oscillator. Automatic gas and water controls are optional.

An arc-balancing circuit and a dual-range output are additional features of the "IGT" models which are manufactured in NEMA ratings of 150, 200, 300, 400, 500 and 750 amp. The tube oscillator and modified torch are available for use with other a-c and d-c welders. Glenn-Roberts Co., Inc., 2107 Adams St., Indianapolis 18.

* * *

Aluminum Welding Rod

JOINING of thin aluminum sheet is said to be facilitated by the new "Eutecrod 900X" welding rod when used with a special flux. The alloy is said to have extreme fluidity, lower bonding temperature, greater capillary flow, corrosion resistance comparable to aluminum and good color match. It bonds at 900 F and remelts at 950 F.

"Eutector Flux 900X" is recommended for use with this rod.

Rod is available in 3/64 and 1/32 in. diameters in coil form. Possible applications are in aircraft, metal goods, aluminum furniture, etc. EUTECTIC WELDING ALLOYS CORP., 40 Worth St., New York City 13.

Built to "take it!"

"K" Welding Torch Handle and Tips, shown with KA Cutting Attachment, which uses standard Cutting Tips.

K-G "E" Welding Torch handling from thinnest gauge up to ½ inch. A "natural" for production welding, silver brazing, auto body and fender work. Has universal helical mixer and separable type tips.

Specify K-G equipment for every welding need . . . better built . . . longer-lasting . . . it cuts costs!

K-G Welding and Cutting equipment is *quality built* . . . That's why it is the choice of experienced metal workers everywhere.

The "K" Welding Torch, pictured above, is a good example — built to take the most severe punishment. Outstanding construction points are its monel head, forged base, exclusive floating mixer seat, and perfectly proportioned handle for fatigue-free grip and easy balance.

Every test to determine resistance to flashback will show K-G welding equipment to good advantage. Under severe abuse, even its largest size welding tip will resist sustained internal combustion.

Ball-and-socket jointed needle valve seats provide never-failing perfect alignment in seating. Needle valve handles are wide spaced for optimum adjustment, *even when heavy gloves are worn.* In this one unit with its attachments, you have a general-purpose welding torch which covers the complete welding range, plus numerous special applications.

For consistent *quality* performance *on every job,* specify K-G Welding and Cutting equipment *every time.*

Write today for our new K-G Equipment Catalog No. 48.

K-G WELDING AND CUTTING COMPANY, Inc.

515 West 29th Street, New York 1, New York

For 34 years manufacturers of unexcelled welding and cutting equipment

A UNIT OF Air Products INC. OXYGEN GENERATING EQUIPMENT

A new K-G policy makes available some choice areas for distributor representation. Inquiries are invited.

Sold in Canada under the name "WELDCO" by Welding and Supplies Co., Ltd., Montreal and Toronto.

Buy from your local distributor — he is equipped to serve you well

REALLY Safe

Snap-Tite

TRADE MARK REG. U.S. PAT. OFFICE

THE WELDING HOSE COUPLER THAT'S UNDERWRITER APPROVED

Here are automatic couplers that are absolutely *safe*. Snap-Tite couplers passed rigorous Underwriters' tests with plenty to spare . . . you'll never need all of the extra margin that is built into Snap-Tite. You get a perfect connection every time. No leaks . . . no cross threading . . . no corrosion.

And you save time and work with Snap-Tite. No wrench is needed. You snap on or snap off the torch by hand—quickly, easily.

And still another advantage — built-in valves close automatically when torch is disconnected. Gas does not have to be shut off at the tank.

GET THE FULL STORY NOW. Ask your distributor for a demonstration . . . or write the factory.

What zippers are to clothes SNAP-TITES are to hose

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Snap-Tite

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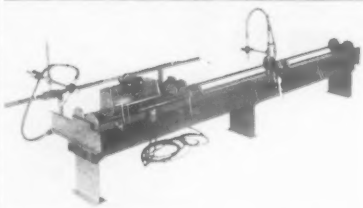
ERIE, PENNSYLVANIA

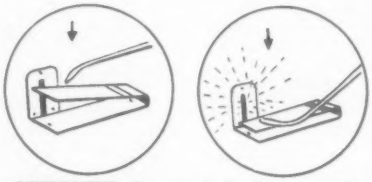


BEVELED or straight edges, curved and angular cuts made on piping by new pantograph-type machine. Above: sample cuts

Pipe-Cutting Machine

SEMIAUTOMATIC flame-cutting machine of pantograph type produces guided cuts for any intersection required in pipe fabrication work. It prepares miter elbows, tees, lateral intersections, any type of curved or angular cut with either straight or beveled edges. Grinding and fitting ordinarily required in pipe fabrication are said to be eliminated. Available for all pipe sizes from 2 to 24 in. VERNON TOOL CO., LTD., 1101 Meridian Ave., Alhambra, Calif.

* * *



DEPRESSING the top leaf of new torch lighter causes sparks to light welding tip

Bench-Model Lighter

BUILT to replace the customary hand lighter for gas welding torches, the new O.K.I. bench lighter produces a series of hot sparks when its upper leaf is depressed by the welding or cutting tip. After opening the acetylene valve on the torch, the end or side of the tip is struck on the top leaf of the lighter. The flint then rubs against a vertical file to release sparks.

Holes are provided in the base and sides to permit the lighter to be fastened to the welding table. It can also be laid on the work or on the ground near a large job. Length is 4 in., width 2½ in. Flint is claimed to last 7,500 times before a replacement is needed. O.K.I. WELDING SUPPLY CO., 12 West Court St., Cincinnati 2.

* * *

Shut-off Valve

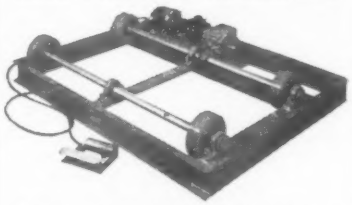
NEW low-pressure "Warden" automatic shut-off valve for use on gas or fluid lines incorporates a precision lapped synthetic rubber seat to provide positive closure. Valve action is mechanical, but value must be reset manually after each closure. Furnished in sizes ¾ in. through 8 in. SECURITY VALVE CO., 410 San Fernando Rd., Los Angeles.

TURNING TANKS IS OUR BUSINESS!

YOU'LL WELD 'EM AT LESS COST IF YOU USE

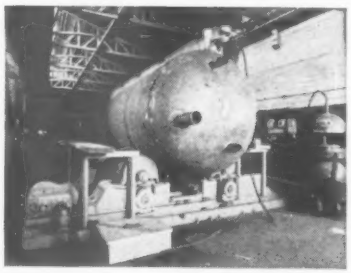
REED ENGINEERED TURNING ROLLS

THE ONLY COMPLETE LINE OF MODERN TANK WELDING EQUIPMENT



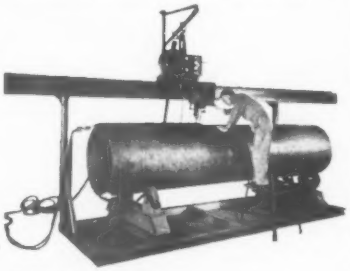
★ THE NEW RD-20 TURNING ROLL

Cap. 2,000 lbs.—handles up to 6 ft. x 12 ft. tanks. Priced at $650.00 F.O.B. Factory. Described in Bulletin No. 70.



★ HEAVY DUTY TURNING ROLLS

Built in 5 standard sizes—3 ton, 6 ton, 12½ ton, 25 ton and 50 ton. Complete details shown in Bulletin No. 68.



★ UNIT TYPE FOR AUTOMATIC WELDING

Combines Turning Rolls and Track Support into one compact unit. Made in 5 standard sizes—Special units made to order.

★ POWER DRIVEN PIPE ROLLS

For accurate fit-up assembly and welding. Both standard and special units built to your requirements.

We Build a Complete Line of Tank Welding Equipment, Including Bending Rolls, Assembly Presses, Horn Jigs, Track Support and Welding Gantries.

COMPLETE INFORMATION MAILED AT YOUR REQUEST

REED ENGINEERING CO.

CARTHAGE MISSOURI U.S.A.

EASY removal of helmet featured on combination cap-type head guard and helmet

Combination Head-Guard and Helmet

QUICK-RELEASE attachment on new M.S.A. combination "Skullgard-Welding Helmet" allows quick removal of helmet from the cap-type head guard. The helmet is joined to the guard by posts fitted with spring catches, which are inserted into plastic lugs on either side of the guard. Light pressure at the forward end of the posts retracts the catches and releases the helmet.

Four one-piece models and two fabricated models of helmets are available. This combination is recommended for weldors employed in shipyards, steel mills, oil refineries, etc. MINE SAFETY APPLIANCES Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.

* * *

DIRECT READING meter gives time in seconds and cycles for checking weld schedule

Weld-Time Meter

LIGHTWEIGHT portable meter measures the duration of welding current in resistance-welding applications and may be used to check the schedule set by the welding control. The instrument is direct reading, giving total weld time in seconds and cycles. If desired, it can be built in the welding machine or control. WESTINGHOUSE ELECTRIC CORP., 306 Fourth Ave., Pittsburgh 30, Pa.

* * *

Acetylene Gun

Pistol-type automatic acetylene torch for soldering, silver brazing, paint, burning, etc., lights when trigger is pressed and is extinguished when trigger is released. The combustion tubes are interchangeable for a range of flame sizes. Acetylene gas is only fuel that may be used. CENTURY AIRCRAFT CO., 5607 West Century Blvd., Los Angeles 45.

For longer service at lower cost

...use Ampco-Weld repairs

instead of replacement parts...

Ampco-Trode 10 Saved this Costly Cast-Iron Gear-Box from the Scrap Heap

Ampco-Trode 10 produces dense, ductile welds in cast iron with a well-brazed bond and low base-metal dilution. Ampco-Trode's ability to weld cast-iron saved the cost of an expensive replacement when this complicated cast-iron gear-box broke into two pieces. Low-cost weld repair with Ampco-Trode 10 put it back in shape for extra years of service. *(Report from Montreal Welding Co., Montreal, Canada.)*

Ampco-Trode 300 Overlays Outlast Chrome Plate 4 to 1 on Draw Punches and Rings

Draw dies fabricated and/or rebuilt with Ampco-Trode 300 last 4 times as long! This more than offsets the lower initial cost of chrome plating. In addition, press-room efficiency gains nearly 15% by eliminating down-time formerly required to hone and polish dies in the middle of production runs! *(Report from Industrial Stamping and Mfg. Co., Detroit, Mich.)*

Phos-Trode Overlays Save nearly $4000 on a Single Turbine Repair Job

More than 20 years of cavitation and pitting had nearly destroyed the vanes and buckets on these 4-ton runners of a water turbine. Replacement would have cost more than $6000 — and there was a chance the original patterns were no longer available. The unit was completely rebuilt with Phos-Trode — restored to original contour — for 1/20th the cost of a replacement unit! *(Report from Montana Power Co., Great Falls, Montana.)*

AMPCO

AMPCO METAL, INC.
Milwaukee 4, Wis.

West of the Rockies it's the **Ampco Burbank Plant**
Burbank, Calif.

You can make similar savings!

Be ready to save in your plant with Ampco-welding. Keep a supply of Ampco Electrodes on hand at all times. Call your nearby Ampco Distributor for his recommendations today!

FREE
Money-Saving Information on AMPCO Welding Electrodes!

TEAR OUT THIS COUPON AND MAIL TODAY!

W-107

AMPCO METAL, INC. Dept. WE-3, Milwaukee 4, Wisconsin
Send complete information on Ampco-Trode, Phos-Trode, and other Ampco arc-welding electrodes.

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Company.....
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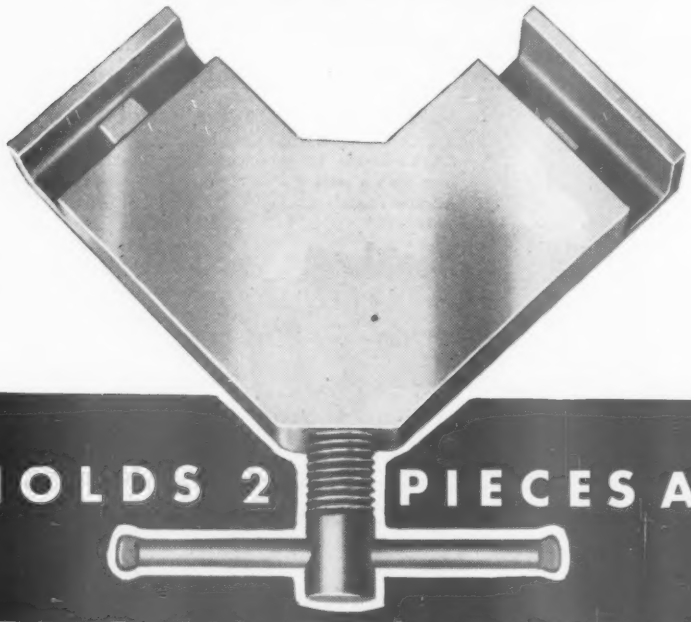
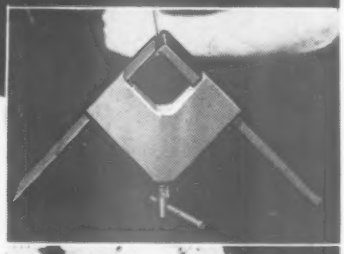
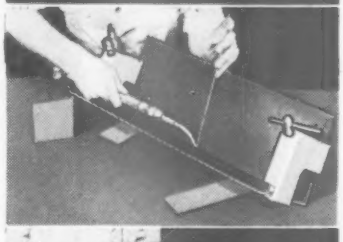


HOLDS 2 PIECES AT
EXACT 90° ANGLE





For quick, easy welding of two pieces of metal, of same or unequal thickness, at positively correct right angle.
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No special fixture needed.
Every welding and sheet metal shop should have Korner-Klamps.
Can more than save their cost on one job.
Save money, time and trouble by asking your welding supply dealer for Korner-Klamps.

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$6.75

THERMACOTE COMPANY
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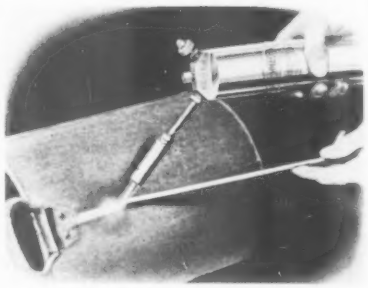


SINGLE control valve furnishes flame of any size on new self-contained heating torch

Air-Gas Torch

BURNING liquid petroleum gas (butane, propane, etc.), the new "Torchmaster" may be used for brazing, soldering and various heating operations. It is claimed to burn upside down or at any angle and has filtered burner that will not clog or blow out. It measures 2¼ by 13 in., holds enough fuel for a day's continuous use. Cost of refueling is said to be from 3 to 5 cents from standard containers. INDUSTRIAL ENGINEERED PRODUCTS CO., 7416 Melrose Ave., Los Angeles 46.

* * *

SPARK shield for flash and spot welding

Face Shield

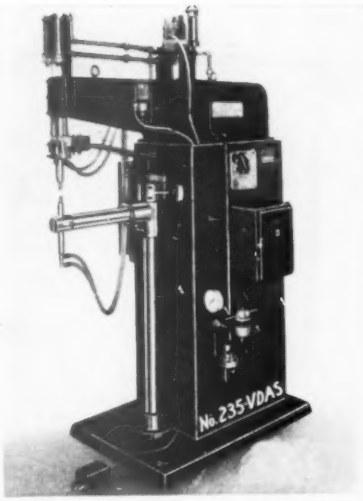
JACKSON'S face shield type J-1 is designed for use on spot, gun and flash welding as well as metal pouring, etc. The shield has a plastic visor made in three thicknesses ranging from 0.020 to 0.040 in. The 0.020-in. thickness is available in three shades of green: light, medium and dark. Improved headgear is made of extruded plastic, fitted with sweat band and pivot assembly. GENERAL SCIENTIFIC CO., 2700 W. Huntington St., Philadelphia 32.

* * *

Heating Torch

GENERAL-PURPOSE heating torch may be used for preheat purposes, thawing pipes, sweating solder into piping joints, burning paint, etc.

This torch operates from bottle gas and an adapter is supplied for attaching the torch hose to the fuel gas cylinder. The torch is expected to have many applications around farms, garages, shops and small factories. It may be used with four tip sizes for ½, ¾, 1 and 2 in. flames. THE L. B. WHITE CO., 422 N. 10th St., La Crosse, Wis.



SOLENOID-actuated valve controls air supply to cylinder of new spot welder

Press-Type Spot Welder

CHIEF feature of an improved Eisler press-type spot welder is a solenoid-actuated valve to control air supply to both sides of the air cylinder. The valve is said to be simpler in action and practically noiseless. Air system also includes a pressure regulator with indicating gauge, an automatic lubricator and an air filter.

Heat adjustment is performed by a heat regulator with dial (seven on-steps and one off-position). Magnetic contactor and weld timer are included in equipment. An electric foot switch initiates the welding cycle.

Electrodes are water-cooled. Electrode holders are adjustable up to a 24-in. opening between arms, and repeating strokes are possible up to 120 per minute. Capacities range from 7.5 to 75 kva. EISLER ENGINEERING CO., 750 South 13th St., Newark, 3, N. J.

* * *

Resistance Heaters

ANNEALING and heating is said to be done at low operating cost (7 to 8 lbs heated per kwh at 2,300 F) with Agnew resistance heaters. While the work is gripped between electrodes, a low-voltage, high-amperage current flows through it. Certain sections can be heated and the remainder left cool as a sharp demarcation is said to exist between hot and cold zones.

Operation is either automatic or semi-automatic with manual or automatic ejection and loading. Annealing, brazing, forging, hardening operations may be performed on these machines. AGNEW ELECTRIC CO., Milford, Mich.

* * *

Aluminum Coating

A METAL coating called "Spekaluminite" requires only dipping or spraying before a final baking operation. It is claimed to resist temperatures of 700 F. The coating adheres to both metals and plastics, resists rust and tarnish (claimed to have withstood more than 200 hours of salt spray) and is said not to peel or flake. The finish resembles bright cadmium. SPECIAL CHEMICALS CORP., 30 Irving Place, New York City.

REGO*

precision regulation

TWO-STAGE
REGOLATOR

for
OXYGEN
ACETYLENE
HYDROGEN

The precision performance of the two-stage RegOlator is especially desirable for piped distribution systems and other applications where large volumes of high pressure gases must be controlled accurately.

Two-Stage RegOlator Gives You Plus Performance!

Constant delivery pressure regardless of drop in pressure at the inlet... Patented design incorporates nozzle-type first stage counterbalanced by stem-type second stage... Triple action cartridge filter eliminates troubles usually caused by rust, dust or dirt.

Write for complete information.

*Reg. U.S. Pat. Office

REGO

The BASTIAN-BLESSING Co.
4201 Peterson Ave. Chicago 30, Ill.

Pioneer and Leader in the Design and Manufacture of Precision Equipment for Using and Controlling High Pressure Gases

The

KENT

SUCTION CLEANER

for

FLUX RECOVERY

Pays for itself by salvaging valuable flux!

This compact, easily portable machine can be adapted to any type of welding application.

The KENT SUCTION CLEANER

The Kent Suction for Flux Recovery picks up the unfused flux and small fused particles from the weld. The fused particles are automatically screened out of the flux and the fine dust is removed—clean flux is then deposited in the lower tank ready to be returned to the automatic welder as needed.

For literature and prices write to:

THE KENT COMPANY, INC.

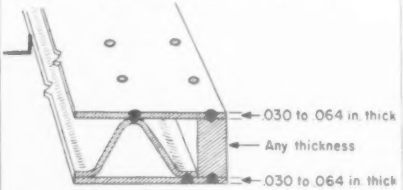
436 Canal St. • Rome, New York

Representatives in Principal Cities

THIN TO THICK sections can be spot welded with new inert arc spot welding process. Single hose contains gas, current, cooling water and controls. Timer is separate unit

Spot-Welding Torch

SPOT welds can be made from one side of the work without back-up by using an inert-gas-shielded spot welding torch, the "Heliarc" HW-8. Mild steel, low-alloy and stainless steel 0.030 to 0.064 in. thick can be welded with currents of from 155 to 250 amp in one to two seconds per spot. One application is to join a sheet of metal to underlying material of any thickness.



Thus corrosion-resistant sheets may be spot welded to mild steel to provide cladding.

Argon gas shields the electrode and weld area, and argon flow and weld duration are accurately controlled by a separate timer unit. The torch may be used on a-c or d-c and has high-frequency starting and arc stabilization.

A single hose assembly an inch in diameter contains all of the conductors for power cable, cooling water, shielding gas and trigger control. Electrode adjustment is made by pushbutton release. THE LINDE AIR PRODUCTS CO., 30 East 42nd St., New York City 17.

* * *

Heat Mask

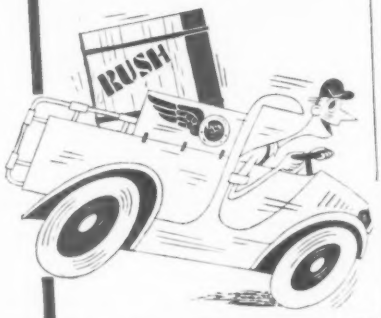
FOR use around preheating furnaces, soaking pits, etc., a new heat mask is said to afford full face and head protection. This mask is made of 30-mesh steel screen which deflects heat away from the searer and prevents infra-red burns. An optional bib and/or snood made of wool is available for extra protection. Weight of the mask is 18 oz., fitted with a fiber chin rest and adjustable headgear. MINE SAFETY APPLIANCES CO., Braddock, Thomas and Meade Sts., Pittsburgh 8.

* * *

Brazing Flux

A NEW general-purpose flux, "Kwikflux No. 54" may be used with either natural gas, hydrogen or oxyacetylene flames or with induction heating. It is recommended for stainless steel, carbon-steel, iron, copper, brass, gold, platinum silver, monel, nickel, nickel silver, etc. Improved wetting and penetration action is claimed. SPECIAL CHEMICALS CORP., 30 Irving Place, New York City 3.

Trying to meet a Deadline? Call us for WELDING SUPPLIES



UNITED STATES STEEL SUPPLY COMPANY
USS
STEELS
SERVICE

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FOR STEEL USERS

These types of Welding Rod for electric arc welding can be shipped promptly from our stocks:

- Mild Steel Electrodes
- Stainless Steel Electrodes
- Hard-Surfacing Electrodes

In addition, our large stocks of other welding supplies enable us to fill your orders without delay. This means that immediate deliveries can be made on Welding Machines, Havens Protected "C" Clamps and Protect-O-Metal (used to simplify removal of welding spatter). Contact our warehouse or sales office nearest you.

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208 S. La Salle St. Chicago 4, Illinois

UNITED STATES STEEL

SLIP-DISCS provide adjustment on rubber headband of new CESCO cup-type goggles

Cup-Type Goggles

MOULDED rubber "Comfort-King" headband on new cup type goggles holds them to head with 30% less tension. The headband is adjusted by patented slip-discs, will not kink, curl or twist and has no buckles or sharp edges.

Also featured are moulded thermoplastic cups which afford 30 to 40% lighter weight. The cups are said to fit both left and right eye areas snugly and gently with broad contact surfaces which eliminate "pressure spots."

This new CESCO goggle is available in various styles for chipping and welding protection. CHICAGO EYE SHIELD CO., 2300 Warren Blvd., Chicago 12, Ill.

* * *

Belt Grinder Backstand

FOR use with abrasive-belt grinders, the new Hammond model 3-A backstand is designed for heavy production grinding or polishing. It has an air-actuated cylinder which automatically maintains correct belt tension compensating for each small variation caused by belt stretch. Since different materials require different belt tensions, the pressure regulator valve may be set for each type. HAMMOND MACHINERY BUILDER, INC., Dept. GP-48, Kalamazoo 54, Mich.

* * *

Stainless Electrode

ALLOY Rods Co.'s new "Arcaloy" a-c/d-c stainless welding electrode is said to have excellent arc starting qualities on all types of a-c weldors and good welding characteristics on either type current. It is claimed to have a smooth, stable arc with fine-spray weld metal transfer. Slag is easily removed leaving no secondary film. Bead is uniform and full throated with straight-line feathered edges. This electrode is available in all chrome-nickel analyses, packed in all-steel moisture-proof containers. ALLOY RODS CO., York, Pa.

* * *

Midget Cylinder Regulators

SEVEN, small single-stage regulators, to be known as the "Midget 7400" series, are designed especially for users of small compressed gas cylinders where hourly gas consumption and space are limited. They weigh one pound 12 oz. each and are constructed for easy maintenance. It is claimed any part may be replaced and the entire regulator reassembled in 15 minutes.

Included in the series are regulators for acetylene, carbon dioxide, liquified petroleum gas, oxygen and air compressors. Several of the models have needle valves, petcocks and gauges as optional parts. VICTOR EQUIPMENT CO., 844 Folsom St., San Francisco 7.

10, 40 and 60 Cu. Ft.
ACETYLENE
CYLINDERS
NOW AVAILABLE
for Early Delivery

New Low Prices
Faster Pumping
Lighter Weights

These are plus features of the new C G Cylinders with the C G C improved porous monolithic filler. Completely tested and approved by the U. S. Bureau of Explosives . . . these new Acetylene Cylinders conform in every detail to ICC specification EIGHT!

All large sizes...100, 150, 250 and 300 minimum Cu. Ft. capacities ... are also available, and hold maximum gas capacities at normal pumping pressures.

New, EASIER TO GRIP OCTAGON CAP

The exclusive CGC Octagon Cap is now available for separate order. 50% thicker dome, 25% lighter weight, smooth finish and extra large shipping tag holes are popular features.

CGC

COMPRESSED GAS CYLINDERS, Inc.
P. O. Box 222, Vernon Branch • 2909 East 54th Street, Los Angeles 11

30 YEARS AGO

(From THE WELDING ENGINEER of April, 1919)

OFFICERS of the new American Welding Society, formed on March 28, 1919, are C. A. Adams, president; J. M. Morehead, vice-president for one year; G. L. Brunner, vice-president for two years; W. E. Symons, treasurer and H. C. Forbes, secretary. Directors of the society include Alexander Churchward, M. H. Roberts, Walter J. Jones, Victor Mauck, E. L. Hirt, J. F. Lincoln, H. M. Hobart, E. L. Mills, James Burke, E. H. Wilson, Jr., C. J. Nyquist and Alexander Jenkins.

At the meeting it was decided that the charter should be held open for ten days and that those applying for membership before April 8 should be considered charter members.

* * *

A SPOT welder recently installed in the Illinois Central Railroad shops at Burnside, Ill., has proved economical for fastening bright tin and black sheet iron, the *Railway Mechanical Engineer* reports. Cost is said to be only 32% of that for riveted fastenings. Kettle ears for buckets, tops for water glass lamps, flat split keys and locomotive jackets have all been successively welded. The magazine predicts an ever-widening use of resistance welding in the railroad industry.

* * *

A WELDORS' club has been formed in Detroit, and weekly lectures and a club library are available to all members. Meetings are held at the Kub Building, Grand Boulevard, Detroit. All welding operators, foremen and inspectors are invited to join.

* * *

LINCOLN ELECTRIC CO., Cleveland, will continue to operate its arc welding school sponsored by the company during the war for the Emergency Fleet Corp. Competent instructors will teach students the fundamentals and proceed to regular production jobs. Heretofore the method has been simply to set the beginner to work on simple jobs and let him work out his own techniques.

* * *

FIFTEEN Chicagoans interested in the welding art met recently to discuss a possible Western section of the newly formed American Welding Society. A regular meeting will be held shortly.

* * *

WINGS of an experimental airplane made of welded steel sheets have been successfully static tested by loading sand bags on them.

* * *

GROUP photos of 75 attractive girl weldors who were trained in oxyacetylene welding on gas masks for the doughboys appear in this issue. Weldors were trained for war production work by W. D. Grant of the Detroit Prest-O-Welding Co.

* * *

GERMAN field guns captured by American doughboys are being flame-cut into charging box size to make steel souvenir medals for the current Victory Loan.

News of the Industry

High Frequency Welders Win FCC Approval

APPROVAL for the "Sureweld Gasarc" high-frequency welder (see page 74) made by the National Cylinder Gas Co., Chicago, was granted in March by the Federal Communications Commission. This is the first instance of approval of such a welder by the FCC. Approval was later granted to the "IGT" model G-R welders made by the Glenn-Roberts Co., Inc., Indianapolis.

In giving its approval to the manufacture these inert-gas arc welders, the FCC acknowledged that characteristics of the new tube-type oscillator and torch will keep the unit on its assigned frequency of 27,120 kc at all times and eliminate the problem of communications interference. The oscillator is used with a specially modified torch assembly.

* * *

Courtesy Nelson Stud Welding Div.,

FEMALE THREADED STUDS are end welded to anchor plate to hold bathroom fixtures

Low-Cost Housing Aided by Stud-Welded Plates

INSTALLATION of bathroom and kitchen plumbing fixtures has been greatly simplified for the over 2,200 dwelling units included in the New York Housing Authority's Gowanus and Astoria housing projects. The fixtures are bolted to threaded female studs, attached to metal anchor plates by means of the stud-welding gun.

The anchor plate is secured to the wall studs with U-bolts in the conventional manner (see picture), after which the wall can be entirely finished, including lath and plaster. Each bathroom plate has seven welded studs: four to suspend the toilet bowl and three supports to wash basin.

The stud-welded anchor plates are fabricated at the J. J. Gribbins Co., Long Island City, which also has a contract to provide similar anchor plates for two other housing projects involving 2,300 dwelling units. Use of the automatic stud-welding gun with simple loading fixtures and templates enables one operator to turn out an average of 30 welded plates in an hour.

* * *

RWMA To Give $2,250 For Prize Papers

SIX prize awards totaling $2,250 for papers on design, application and research in resistance welding have been announced by the Resistance Welder Manufacturers' Association.

Top prize of $750 will be awarded for the best paper from an industrial source, including not only manufacturing but also consulting engineering and laboratory organizations. Authors of the second and third best papers in this category will be given prizes of $500 and $250, respectively.

The best paper by a university instructor, student or research fellow will merit a prize of $300. A $200 prize will be given for the second best paper. Also added for the first time this year is a $250 prize to be awarded for the best paper by an undergraduate.

Anyone in the United States or Canada is eligible to compete for these prizes. Copies of the rules governing the awards are available from the RWMA office at 505 Arch St., Philadelphia 6.

* * *

Senator Mundt to Speak At IAA Pittsburgh Meeting

FEATURED speaker at the 1949 convention of the International Acetylene Association at the William Penn Hotel in Pittsburgh, April 25-26, will be Senator Karl E. Mundt of South Dakota. Senator Mundt will speak at the luncheon meeting on April 25, on the challenges confronting industry and private enterprise. The Morehead Medal will be also presented at this time.

Two days of technical sessions will be given in cooperation with the University of Pittsburgh and Carnegie Tech.

* * *

Stress Analysis Society Plans Detroit Meeting

THE spring meeting of the Society for Experimental Stress Analysis will be held at Hotel Statler, Detroit, Mich., on May 19, 20 and 21. Inquiries should be addressed to the society's office address, P. O. Box 168, Cambridge 39, Mass.

* * *

Victor X-Ray Corp. Becomes G-E X-Ray

VICTOR X-Ray Corp. of Canada, Ltd., has changed its name to General Electric X-Ray Corp., Ltd., paralleling the name of its U. S. affiliate, the General Electric X-Ray Corp., Milwaukee, Wis.

Manager of the Canadian firm is E. W. Hollingum, Montreal.

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Thousands of P&H Dial-lectric AC Welders *are Cutting Costs Daily**

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The P&H built-in remote control saves you real money—it turns your weldor's walking time into welding time, gives him full finger-tip arc control at the work, lets him produce sounder, better-looking welds.

Trim your welding costs in a hurry. Install a P&H Dial-lectric AC Arc Welder — see the money-saving difference. Your P&H representative or distributor can give you more facts. Write for literature.

*Only 1½ years after their introduction to the field.

Additional Features That Keep Welding Costs to a Minimum

- Easy quick-start arc
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- A full range of sizes up to 625 amps.
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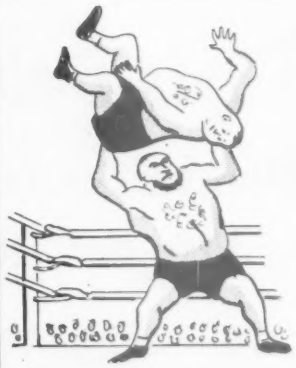

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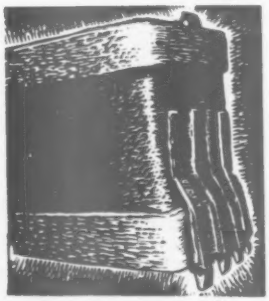

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Final Plans Announced For Ohio Welding Conference

TENTH Annual Ohio Welding Conference will be held April 7 and 8 at Ohio State University, Columbus., under sponsorship of the Ohio State Department of Welding Engineering in cooperation with Ohio sections of the American Welding Society.

Included on the program of technical sessions to be presented Thursday and Friday is C. B. Voldrich, Battelle Memorial Institute, who will speak on the strength of welded joints in thick aluminum plate. Safe practices in oxy-acetylene welding and cutting will be discussed by James J. Banash, consulting engineer. R. M. Dennis, By-Products Steel Co., will talk on machine gas cutting procedures.

The industrial use of modified armor plate steel will be discussed by A. F. Busick, Jr., Marion Power Shovel Co. Creative design with welded rigid frames will be handled by Martin P. Korn, consulting engineer.

James F. Deffenbaugh, Federal Machine and Welder Co., will speak on resistance welders. E. A. Mallett, The Taylor-Winfield Corp., will talk about jigs and fixtures for resistance welding. Tooling for resistance-welding production will be discussed by William H. Kearns, Lustron Corp.

Further information about the conference may be obtained from R. S. Green, Dept. of Welding Engineering, Ohio State University, Columbus 10, Ohio.

* * *

Ductile Cast Iron Develops High Tensile Strengths

A NEW material described as ductile cast iron is said to combine the process advantages of gray cast iron (fluidity, castability, and machinability) with the product advantages of cast steel. It was developed in the research laboratories of the Development and Research Division of the International Nickel Co., Inc.

Ductile cast iron is characterized by a graphite structure in the form of spheroids, free from graphite in the flake form. The spheroids are formed by the introduction into the molten iron of a nickel-magnesium alloy. The new iron's high elastic modulus, high yield strength and ductility suggests its suitability for automotive, farm, railroad and marine equipment of many types. Under stress it behaves elastically like cast steel. In the as-cast condition, tensile strength ranges from 85,000 to 105,000 psi for pearlitic grades of cupola-melted material containing 3.2 to 3.6% carbon and 1.8 to 2.8% silicon.

* * *

White Metal Plant Opens In Salt Lake City

NON-FERROUS white metal alloys will be manufactured in a new branch plant opened in December in Salt Lake City by Morris P. Kirk and Son, Inc., Los Angeles.

The company is a subsidiary of National Lead Co. Lead pipe, sheet lead and lead valves will be distributed by the firm. Setting up of the factory is said to be a result of the move of several battery manufacturing plants to the area.

BETTER public understanding of industry sought by William J. Sampson, Jr., president of Industrial Information Institute

Welding Man Heads Information Institute

A VARIED and practical program to tell the public in the Youngstown, O., area about industrial problems and opportunities has been successfully carried out the past 18 months by the Industrial Information Institute. This aggressive organization is headed by William J. Sampson, Jr., president of American Welding & Manufacturing Co., Warren, O.

More than 85 companies, banks, and business firms in Mahoning, Columbiana, Trumbull and Mercer counties are members of the institute, which has as its main aim the relating of the story of business and industry in those counties. "Today we realize that public opinion affects profits, that community relations affect profits and that we must open our doors to the public," asserts President Sampson.

School pupils in eastern Ohio-western Pennsylvania schools are being acquainted with the importance of the $2,600,000,000 a year industry in their area. A series of textbooks, one for each grade from the third through high school, is published to tell the young students how people earn their living locally and what are the nearby natural resources, local transportation, etc.

Other projects which the institute sponsors are an "Industrial Week" display, with many exhibits in downtown store windows of local cities; co-operation with county foremen's associations; special industrial tours for school teachers and principals; "open houses" by member companies; preparation of a manual which describes various potential jobs; regular visits by company executives to schools to talk to the pupils. A 16-page color cartoon book for children has also been distributed.

* * *

Sutton-Garten Issues Anniversary Welding Catalog

THE thirtieth anniversary catalog of the Sutton-Garten Co., 401 West Vermont St., Indianapolis 2, Ind., has recently been published. It provides a complete listing of the arc and gas welding equipment, supplies and accessories handled by this distributor.

Multi-Pic — THE FIRST REAL IMPROVEMENT IN WELD HAMMERS

NOW EQUIPPED WITH Repeater Brush

THAT WEARS AND WEARS AND WEARS AND WEARS

Multi-Pic is the improved weld hammer with 5 separate pic-pointed tool steel heads locked between free floating guide plates. Each single stroke of **Multi-Pic** gives five surface cleaning blows. The five picks adjust themselves automatically to the varied surface of any concave, convex or irregular shaped weld and clean quickly, easily, with fewer blows. Pic points are hardened, tempered tool steel which lasts indefinitely and can be resharpened.

Repeater Brush whisks away loosened slag, oxides and rust in a jiffy. The unique design makes it easy to reach into the deepest corners and crevices. The crimped oil hardened wire brush is provided with five quick and simple adjustments to compensate for wear and lasts five times as long as an ordinary brush.

Multi-Pic is supplied with double 5-pic pointed ends or with dual 5-pic and 25-pic pointed ends **as illustated** with or without the Repeater Brush. Extra Brushes—three in a carton.

ORDER FROM YOUR DEALER TODAY!

Try **Multi-Pic** in your own shop—on your own work. You'll welcome the quick, cleaner work of this new weld hammer which follows the contour.
If your dealer cannot supply you, write us for descriptive folder and name of nearest supply house.

Patents Pending.

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ANY SIZE
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ANY GRADE

There is a BBB Brush for every type and make of welding equipment. Each is designed as an exact replacement part for the equipment designated — each is guaranteed to perform satisfactorily — each benefits from BBB's 58 years of manufacturing experience. For Brush service you can depend on, ask your Jobber for BBB Brushes by name.

A COMPLETE LINE OF CARBON WELDING SUPPLIES. In addition to Brushes, the BBB Line includes Keen-Arc Carbons, Carbon and Graphite Electrodes, Carbon Welding Paste, Carbon Rods and Welding Plates. Write for indexed and illustrated catalog.

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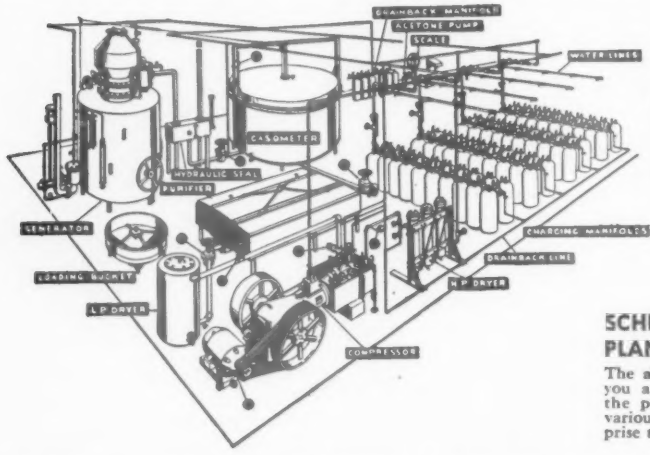
A *Low Pressure* ACETYLENE PRODUCING PLANT that Charges up to 160 CYLINDERS at ONE TIME



SCHEMATIC PLANT ASSEMBLY
The above sketch gives you a general view of the placement of the various units that comprise the plant.

For the Prospective Gas Manufacturer this complete plant layout provides for extremely *simple* operation and exceptionally *low* maintenance costs. The entire plant is designed to provide ample storage room for filled tanks and compact enough for the Chief operator to observe all operations. Rated capacity, 2700 cu. ft. per hour.

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WE INVITE YOUR INQUIRIES

Valuable Information At Purdue Conference

HELD in the Michael Golden Engineering Laboratories at Purdue University, Lafayette, Ind., Feb. 8 and 9, the 20th Annual Purdue Welding Conference offered to its audience a good chance to catch up with recent welding developments.

Technical program was opened by Professor R. W. Lindley, chairman of the manufacturing processes laboratory at Purdue and general chairman of the conference. The single paper given Tuesday morning was by W. G. Fetter, manager, resistance welding division, P. R. Mallory and Co., Inc., who discussed recent development in resistance-welding electrodes.

Two resistance-welding papers were read Tuesday afternoon. How welding may replace soldering was discussed by R. F. Smith, assistant welding engineer, Delco-Remy Division, General Motors Corp. Methods of developing production welding techniques were suggested by J. R. Wirt, welding engineer, Delco-Remy Division, General Motors Corp. Following the presentation of these papers, Professor O. D. Lascoe conducted the visitors on a tour of the new machine tool laboratory of Purdue University.

A varied program was started on Wednesday morning by Lawrence Naberhaus, industrial engineer, The Cincinnati Milling Machine Co., who talked on weldments versus cast iron structures. Uses of stud welding were presented by R. C. Singleton, customer engineering manager, Nelson Stud Welding Division, Morton Gregory Corp. C. A. Heffernon of the Linde Air Products Co. talked about applications of inert-arc welding.

"The Welding of Light Gauge Tubing" was discussed at the Wednesday afternoon session by C. E. Daig, assistant superintendent, Unit & Water Heater Division, Servel, Inc. Low-temperature silver brazing was the subject of a paper by A. M. Setapen, engineering division, Handy and Harman. Professor Lindley gave the last technical paper entitled "Machine Flame-Cutting with City Gas."

Closing address of the meeting, "What Welding Means to America," was delivered by T. B. Jefferson, editor of THE WELDING ENGINEER.

Though this was not the best attended of the 20 welding conferences that have been presented at Purdue University, the consensus of opinion among those present was that it was by far the most interesting and educational.

* * *

Harnischfeger Builds Office at Dallas to Serve Southwest

Construction of a new office and warehouse at Dallas, Tex., was begun recently for Harnischfeger Corp., Milwaukee. This is a one-story building with warehouse space that will total more than 10,000 sq. ft. A PH 50-ft span overhead electric crane will be installed.

Entire line of Harnischfeger products, including arc welders and electrodes, power shovels, truck cranes, electric excavators, soil stabilizers and electric cranes and hoists will be carried in the new quarters.

Chicago AWS Section Wins Welding Quiz Championship

Chicago section of the American Welding Society sent the winning team to the annual intersectional "Quiz the Experts" night sponsored by the Detroit section on Feb. 11. Four cities sent teams: Chicago, Detroit, Grand Rapids and Fort Wayne. Last year the Chicago section won an international contest of the same type.

Chicago team members were: T. B. Jefferson, editor of The Welding Engineer, captain; H. A. Goodwin, Bastian-Blessing Co.; Dr. John Parks, Armour Research Division, Illinois Institute of Technology and C. L. Pfeiffer, consulting engineer.

Twelve questions worth 10 points each were presented to the contestants, providing a possible 120 points. The Chicago team won 44 points to beat Detroit with 28.

The Detroit section team was led by Jack Ogden, Fisher Body Division, General Motors Corp., and included E. H. Horton, Horton Welding Co.; Reginald Jamieson, Air Reduction Sales Co., and A. Fullenwider, Midland Steel Products Co.

Third place was captured by the Western Michigan section of Grand Rapids, Mich. R. E. Kemp, American Seating Co., was captain. Other team members were Otis M. Flenar, Rudd Mfg. Co.; Clarence Lonkenau, National Cylinder Gas Co. and E. Y. Bunting, Kilpatrick and Martin.

Anthony Wayne section from Fort Wayne, Ind., was captained by Harry M. Johnson, Wayne Welding Supply Co., Inc. Fellow team members were Max Clark, Wayne Welding Supply Co., Inc.; Virgil Beck, Beck Welding Co., Carl L. Gavy, K & G Mfg. Co.

Judges of the contest were: J. J. Chyle, A. O. Smith Corp., Milwaukee; S. W. Snell, Odland Iron Works, Inc., Toledo, O., and J. G. Magrath, Executive Secretary of the American Welding Society, New York City. John F. Randall, Ford Motor Co., Detroit, acted as moderator.

* * *

U.S.S.R. Builds First Welded Railroad Bridge

The Soviet Union's first arc-welded railroad bridge has been produced by the Molotov structural steel works in Dnepropetrovsk, near the Dnieper Dam power plant. The Dnepropetrovsk works now has underway a program for mass production of welded-type structural steel for bridge building.

Application of welded design to bridges follows the development of Russia's first all-welded blast furnace for the Zaporozhye steel works. This was likewise a development of the nearby Dnepropetrovsk works.

—*McGraw-Hill World News*

* * *

Aluminum Building Shapes Placed on the Market

Reynolds Metals Co. is now producing a line of standard architectural shapes in extruded aluminum. Shapes now available include thresholds, window sills, jambs, mouldings, base mouldings, handrails with balusters, copings, and many others. These items will be stocked by distributors in 50 cities.

Welding IS EASIER, MORE PROFITABLE with TRINDL ARC WELDERS

MODEL 125A WELDER

A Big Money Saver For Any Shop

Only $69.50 F. O. B. Factory

Complete-Ready-To-Operate

SAVES TIME • REDUCES COSTS • INCREASES PROFITS!

This exclusive, easy-to-operate TRINDL WELDER is a big saver for any shop . . . MODEL 125A is ruggedly built . . . Can easily be carried right to the job and connected to any convenient properly wired 110 volt 50-60 cycle AC supply line . . . With it you can BUILD OR REPAIR auto and home appliance, farm implements and tools . . . Fabricate special shop equipment, jigs and fixtures out of prime or scrap sheets, bars and tubes and do hundreds of other repair and construction welding jobs when you need them and as you want them done. MODEL 125A has 16 heat stages ranging from 20 to 125 amps, handles 1-16" to 5-32" rods . . . Comes Complete Ready to Operate—Nothing Else to Buy. Also available for 220 and other voltages at slight additional cost.

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Trindl "JOB-TESTED" ARC WELDERS

A RANGE OF MODELS FOR EVERY WELDING JOB!

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USE THE NEW

FLUX-POT for FAST EFFICIENT FLUX HANDLING

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Unit complete with 6-ft. rubber cord and plug.

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Fully automatic thermostat control set to keep flux at constant 180° temperature.

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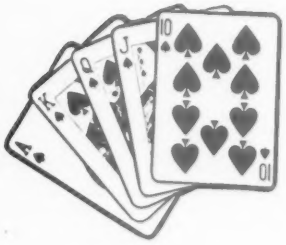
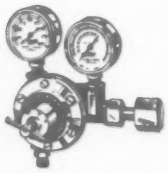


Only MECO can boast so many features—stainless steel valve nozzles, precision ground and checked under powerful magnification to assure accurate, uniform regulation and longer life. Stainless steel screw-clamped diaphragms provide for greater accuracy and strength because they are secured by torqued-on steel cap screws that neither crimp or distort out of shape.

Built-in Safe-T-Chek Valves protect the regulator against sudden high pressures—with Multi-Seats for uninterrupted production on the job. That's why MECO Regulators are always a *sure bet* for *dependable service.*

Type GC Safe-T-Chek Regulator—for use in both light and heavy welding and cutting.



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- 4 MODELS—20-335 AMPS
- NEW STREAMLINED CASE
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For light production—for maintenance and repair—select the New "70" Series Model that best fits your requirements. They're all quality-built, service-tested for long-time, trouble-free, economical use!

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ANODE of 400,000 volt X-ray tube being sealed in by skilled glass-blower at General Electric X-Ray Corp.'s Coolidge Laboratory at Milwaukee. Anodes are themselves checked by X-ray to search for porosity, other flaws

X-Ray Units Serve Many Industrial Uses

A CABLE control casting in a 15-ton iron ore bucket suddenly failed. When X-rayed, it showed numerous flaws. Its replacement was also X-rayed and found wanting. A second replacement was radiographed and upon being found fit was installed to give continuously trouble-free service.

"Peels" (cast cylinders some 20 ft long and weighing 6 tons) are being X-rayed before charging in open-hearth furnaces. Such small parts such as brass orifices and gauges are also tested to determine their quality. Weldors' torches are likewise X-rayed.

X-ray diffraction units are also finding increasingly broad fields of application. For instance, X-ray diffraction is used as a partial substitute for exposure tests in determining the austenitic phase of certain heat and corrosion-resistant alloys. The related tool of electron diffraction provides patterns from very thin layers and has been found useful in the study of surface films of metals used for corrosion protection.

Finally, many parts of X-ray units are themselves checked by X-ray, before both installation and after prolonged use to determine possible flaws.

* * *

New Safety Under Water

A NEW automatic device perfected by the welding laboratory of the U. S. Naval Engineering Experimental Station, Annapolis, Md., cuts down the current supplied to a welding electrode when it is not in use in order to lessen the danger of electrocuting the diver. The same gadget can be used in oxy-arc cutting.

* * *

Ohio School Buys Welding Equipment

BOARD of education at Wellington, O., has voted to purchase oxyacetylene welding equipment from war surplus stocks. New equipment will be used in welding and allied shop work in the Wellington public schools. Homer Barbe, industrial arts teacher, will supervise the program.

Western NWSA Meeting Has Good Attendance

FORTY welding manufacturers and distributors attended the Feb. 22 zone meeting of the National Welding Supply Association in San Francisco. Attendance was considered one of the largest for the zone. Hal Savage, Arizona Welding Equipment Co., Phoenix, Ariz., western regional vice-president of the association, presided.

The "Manufacturer's Responsibility to the Distributor" was outlined by Ralph E. Todd, assistant to the sales manager of Victor Equipment Co., San Francisco. Proper engineering, steadfast guarantees, good operations instruction, an accurate competitive picture and attractive promotional and sales plans are up to the manufacturer, Mr. Todd said. The distributor should match this, he added, with effective stocking and sales policies.

Other problems considered at round table discussions were written sales policies for manufacturers and the need for margins sufficient to cover increased costs. All the conferees agreed that a buyer's market is returning and that sales techniques must be improved.

Three new memberships were gained at the meeting: H. E. Bailey, Bailey Equipment Co., San Diego, Calif.; J. G. Duff, of Gordon Duff, Los Angeles and G. M. Sims, ABSCO Welding Supplies, Los Angeles.

* * *

Stainless Sheathed Dam Gates To Be Welded by Koppers Co.

TWENTY-SIX welded gates, each weighing 35 tons and sheathed in stainless steel, will be built by the Metal Products Division of Koppers Co., Inc., for the Conemaugh River dam in western Pennsylvania. The stainless sheathing is necessary because of the high degree of acidity of the water, much of which comes from mines. The sheathing is ¼-in. thick and is bonded to the ¾-in. steel of the gate face by a special process calling for intricate V-welds that must be made by highly skilled welders. Cylinders operating the gates will also be welded and X-rayed for soundness. Each cylinder weighs 11,000 lb.

* * *

Lectro-Weld, Inc. Formed at Cleveland

JOHN A. Campbell, Jr., and Lester J. Farber have formed Lectro-Weld, Inc., at Cleveland for the fabrication of steel. Mr. Campbell and Mr. Farber are president and treasurer, respectively.

Plant and equipment of the Manufacturers Welding Co. was purchased by Lectro-Weld. An addition to be built will provide a total of 8,000 sq ft. for operations.

* * *

New Distributors

TITAN METAL MFG. CO., Bellefonte, Pa., has named Fulton Supply Co., 342 Nelson St., S.W., Atlanta, Ga. as a distributor for their line of brass and bronze rods.

* * *

REYNOLDS METAL CO., Louisville, Ky., has named The American Brass & Copper Co., Oakland, Calif., as a specialty distributor of Reynolds products.

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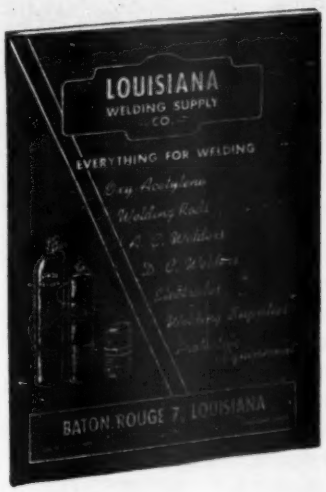

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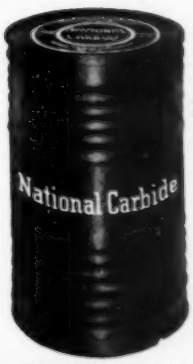

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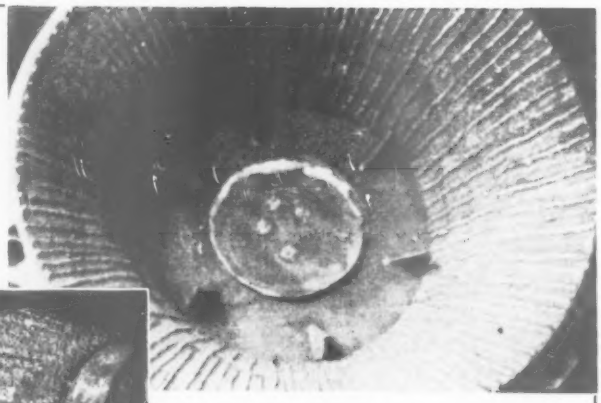
At right: Gyratory mounted on positioner.

Below: Completed two-stage mantle. Note perfect contour.



Gyratory Crusher Liners and Mantles are easily rebuilt by this process of using MANGA-TONE N.M. and a mild steel electrode. Warping due to welding heat is practically eliminated. After rebuilding with MANGA-TONE N.M. RESISTO-LOY beads are laid on the rebuilt plate ribs, on the liners and mantles with the result that a rebuilt part will outlast and out-perform new parts better than 3 to 1. RESISTO-LOY will not chip, spall or flake off under severe impact. MANGA-TONE N.M. enables you to do a better rebuilding job in a third of the time.

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AWS Program Announced for Western Metal Show

A COMPREHENSIVE technical program has been approved for the Western Metal Congress and Exposition, at Shrine Civic Auditorium and the Biltmore Hotel, Los Angeles, April 11-15. The welding program is under sponsorship of the Los Angeles chapter of the American Welding Society.

At the Biltmore Hotel on Monday morning, April 11, Charles A. Babbitt, vice-president, Cal-Metal Corp., Torrance, Calif., will discuss tandem-arc submerged-melt welding of line pipe. The automatic welding of pressure vessels will be described by Clinton E. Swift, welding engineer, C. F. Braun & Co., Alhambra, Calif. H. W. Sharp, chief engineer of the Stoody Co., Whittier, Calif., will talk on developments in automatic hard-facing.

Welding research will be reviewed in three papers to be given Monday afternoon at Shrine Convention Hall. A panel discussion on welding metallurgy will be presented at the Shrine hall at 8 p. m. Monday evening.

On Tuesday morning, April 12, the welding sessions will begin at the Biltmore with a talk on electrode coatings by John J. Chyle, director of welding research, A. O. Smith Corp., Milwaukee. Myron D. Stepath, welding engineer, Puget Sound Naval Shipyard, Bremerton, Wash., will discuss cutting and gouging by arc-air processes. Silver-brazed joints will be the subject of a paper presented by A. M. Setapen, manager, engineering division, Handy & Harman Co., New York City. Tuesday afternoon will be open to allow visits to exhibits, but a welding design clinic will be held Tuesday evening at the Shrine hall.

Inert-gas shielded-arc welding will be the central theme of three papers presented on Wednesday morning, April 13, at the Biltmore. Tom E. Piper, chief process engineer, Northrup Aircraft, Inc., Hawthorne, Calif., will discuss the application of inert-gas arc welding to airframes and engines. The new "Aircomatic" process is the subject of a talk by E. H. Roper, assistant manager, technical sales division, Air Reduction Sales Co., New York City. "Heliarc" welding in production will be discussed by F. J. Pilia, research engineer, Linde Air Products Co., Newark, N. J.

Non-ferrous alloys will be discussed in welding sessions Wednesday afternoon at Shrine hall. The welding of aluminum will be the subject of a talk by C. B. Voldrich, chief welding engineer at Battelle Memorial Institute, Columbus, O. Kenneth M. Spicer, technical service department, International Nickel Co., New York City, will discuss welding of high-nickel alloys. Frank G. Harkins, welding engineer, Solar Aircraft Co., San Diego, Calif., will present a paper on "Resistance Welding of Nickel Alloys."

Aircraft welding will be the subject of a panel discussion Wednesday night at the Shrine hall.

Thursday morning at Shrine hall, a three-paper series on resistance-welding will be given. Robert T. Gillette, welding engineer, works laboratory, General Electric Co., Schenectady, N. Y. will talk on the history, design, control and application of resistance welding. Developments in re-

sistance welding controls will be discussed by Eugene Lica, electrical engineer, Douglas Aircraft Co., Santa Monica, Calif. J. H. Cooper, chief sales engineer, Taylor-Winfield Corp., Warren, O., will talk about three-phase resistance welding machines.

Thursday afternoon is again free and on Thursday evening will be held the joint banquet with the American Society for Metals at the Biltmore Bowl.

Codes, safety and inspection will be the general theme of the last technical session on Friday morning. Changes in pressure-vessel codes will be reviewed by Elmer O. Bergman, construction engineer, C. F. Braun & Co., Alhambra, Calif. The California code for compressed gases will be discussed by George A. Sherman, of the State division of industrial safety, San Francisco. S. J. Artese, test engineer, Shell Chemical Co., Wilmington, Calif., will talk about non-destructive testing of welded refinery equipment.

* * *

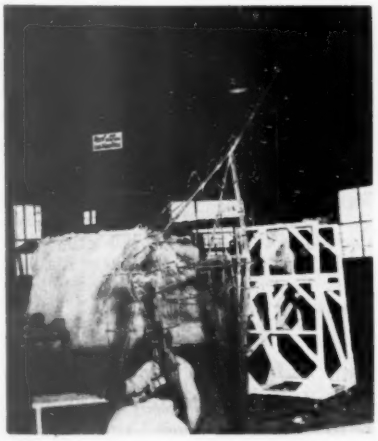
Less Chrome and Manganese If Russia Stops Shipments

AMERICAN importers were recently informed by Soviet trade officials that it may not be possible to deliver full quotas of manganese and chromium because of "increased requirements" at home. Thirty-five per cent of our imports of manganese and 40 per cent of our imported chromium will be affected if Russia stops her shipments of these minerals as threatened.

Russia produces about 2.4 million tons of manganese a year, of which half is exported. The remainder is far more than enough to supply the Soviet steel industry, which has an estimated capacity of 15-million ingot metric tons.

American officials think the Russians are bluffing, floating a trial balloon to see how excited we'll get over it. Even if they are not, it will be possible for us to expand alternate sources of supply. For manganese that means South Africa, the Gold Coast, India and Brazil; for chrome, Turkey, Southern Rhodesia and New Caledonia.

* * *



GIRAFFE SKELETON of welded rods was built by E. H. Daniels Associates, Pasadena, Calif., for Standard Oil of California's entry in the Tournament of Roses parade this year. It's a new way to use welding!

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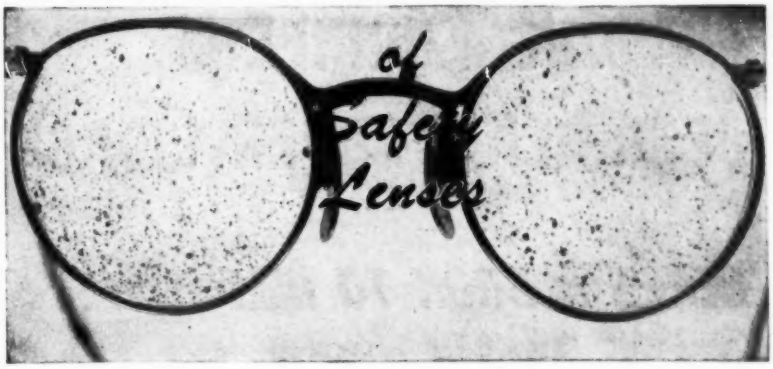

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The price for this dual-purpose unit is considerably under that of any individual 5 KVA spot welder or 120-ampere arc welder! That's due to Delta's unique design, careful engineering, and high-production methods.

Delta is a name you can count on for high quality. True, it's a new name in welding.

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Have your nearby Delta distributor show you the new Delta Combination Welder. Get a better idea of the many ways that you can use it profitably. Also see the new Delta 5 KVA Spot Welder and Delta Portable Arc Welder. And ask about buying on easy, convenient time payments.

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Railroads Use New Ultra-Violet Inspection

A METHOD of inspecting parts that makes use of a fluorescent liquid and ultra-violet light is gaining wide application in railroad shops, according to Ray McBrian, engineer of standards and research, Denver & Rio Grande Western Railroad. The method is said to be four to five times faster than any dry method of inspection. Complete inspection of an axle can be made in about two and one half minutes. A check of the wheelseat and the journal requires only 90 seconds.

The two fluorescent-liquid inspection methods used are commonly termed "magnaglow" and "zyglo." In the "zyglo" process, a fluorescent liquid of high penetrating power is used as a bath for the part. The surface penetrant is then removed and the part placed under ultra-violet light. If there are any defects in the material, the fluorescent liquid remaining in the cracks will glow.

For magnetic materials a special paste is mixed with oil to form a suspension of fluorescent ferro-magnetic particles. A magnetic field is then induced in the part to be inspected. The leakage field around a defect attracts and holds the glowing particles, thus giving definite indications of the location, extent and shape of the defect.

* * *

General Electric Increases Service Facilities in West

NEW service shop-warehouses in Salt Lake City and Seattle, Wash., will provide expanded repair, maintenance and warehousing facilities for service on General Electric apparatus in the mountain states and the northwestern U. S.

Equipment and construction worth $500,000 will increase warehouse space 50% and double the capacity for service and repair of motors, generators, control devices, etc., at Salt Lake City. The enlarged apparatus service shop at Seattle provides heavy equipment repair and reconditioning, aircraft equipment servicing and a manufacturing section in which all types of standard and special control and switch gear are produced.

* * *

Order Aluminum Cars For London Subway

AN order for ninety cars for the District Line Underground (London subway) has been placed by the London Transport. These cars will be made of aluminum alloy and are expected to cost $5,000,000. The Metropolitan-Cammell Carriage and Wagon Co. at Saltley, Birmingham, will fabricate the coaches. Aluminum will come from I.C.I. Metals Division at Witton, Birmingham. First of the cars are expected to go into service some time in 1951.

—McGraw-Hill World News

* * *

New Publication for Distributor Salesmen

EUTECTIC Welding Alloys Corp., New York City, has begun distribution of a monthly 16-page publication called "Eutecrod-of-the-month." Each issue will cover the features, applications and properties of one particular electrode or welding rod.

The Technical Slant

Welding Design

WELDING DESIGN HANDBOOK. Compiled by T. B. Jefferson. Published by The Welding Engineer, New York City 18, 1948. Paper, 8x11 in.; 86 pages. Price $1.50.

The seven compact chapters of this handbook contain a wealth of information for those responsible for welding and welded design in industrial plants. No matter whether the designer, engineer or supervisor is called upon to design a structure and specify materials, processes and equipment to be used in its fabrication, or merely is in search of engineering tables, most of the answers will be found in WELDING DESIGN HANDBOOK.

The first chapter presents in concise data-sheet form information pertaining to the oxyacetylene flame, welding fluxes, flame-cutting, electrode classification and standards, resistance-welding fundamentals and welding control tubes. Chapter two covers welding symbols, weld stresses, joint design and tank design data.

An extremely compact section on welding design gives such information as design approach; material selection, methods of fabricating; metal, time and cost saving factors and fundamental welding design data.

The closing chapter of the WELDING DESIGN HANDBOOK contains such engineering tables as trigonometric solutions; conversion tables which cover practically all of the conversion information wanted by an engineer, as well as tables on weight and measures, decimal equivalents, etc. While all of the material has been reprinted from THE WELDING ENGINEER, it is here compiled in one cover into a single handy volume of pertinent up-to-the-minute design information. The book is highly recommended for engineers, designers, supervisors and others who are interested in welding.

* * *

Steel Fabrication

STEEL PLATES AND THEIR FABRICATION. Edited by Lionel S. Marks. Published by Lukens Steel Co., Coatesville, Pa., 1947. Cloth, 6x9 in.; 408 pages. Price $5.00.

STEEL PLATES AND THEIR FABRICATION is a comprehensive treatise on the science of steel production. Opening with historical data on early steel making in this country, the book carries the story up to such modern processes as forming, flanging, pressing, flame-cutting, welding, riveting and fabricating assemblies, pressure vessels and tanks. Such present-day production problems as the effect of plate width on fabrication costs and the strength of flat plates and shells are reviewed. Each part of the text is illustrated.

Commercially standardized formed plates such as flanged and dished heads are discussed, and detailed analyses are given of the strength of plates subjected to a wide range of support and loading conditions.

Welding and flame-cutting are discussed in several chapters and will be of special interest to all readers of THE WELDING ENGINEER. The final section of general engineering information, mathematical and conversion tables will be useful.

Fuse-Weld Cast Welding Rods

THE STANDARD OF QUALITY THROUGHOUT THE WORLD

PLAIN AND ALLOYED GREY IRON
WELDING RODS
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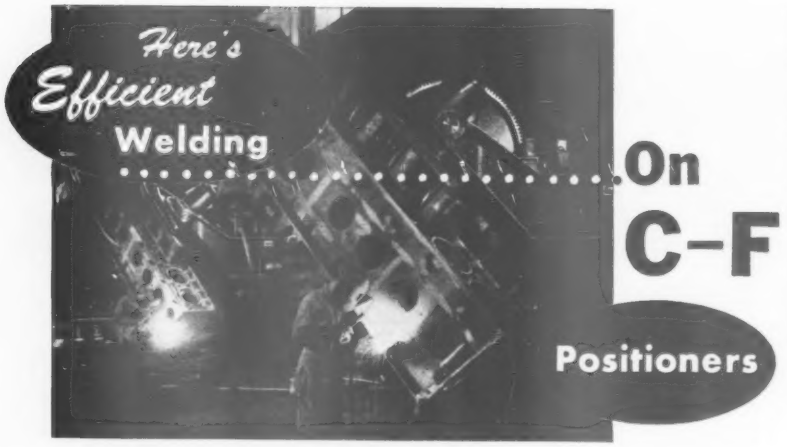

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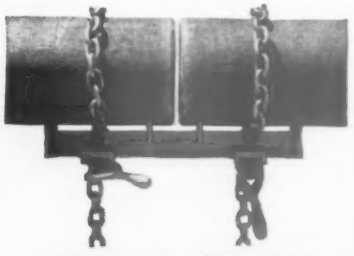

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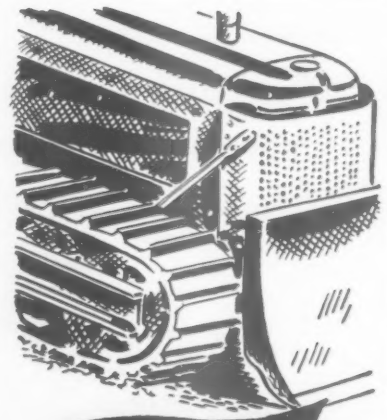

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About People

R. P. McMillan has been appointed vice-president and general manager of Southern Oxygen Co., Inc. He will have general direction of the company's sales. Other officers are: R. B. Swope, president; W. N. Howison, secretary; R. L. Swope, treasurer; H. E. Eby, assistant treasurer. Board of directors includes R. B. Swope, R. P. McMillan, W. N. Howison, R. L. Swope, J. K. Moyer, H. T. Bisselle and James M. Johnston.

* * *

Dr. John F. Thompson has become president of The International Nickel Co. of Canada, Limited. Dr. Paul D. Merica has become vice-president and Henry S. Wingate has become a vice-president while continuing as secretary.

* * *

Charles T. Morgan, Beverly, Mass., has been appointed New England sales representative of Sperry Products, Inc., makers of ultrasonic inspection instruments.

* * *

James K. Calhoun has joined The Bastian-Blessing Co., Chicago, as a sales engineer for RegO welding and cutting equipment.

* * *

Vincent A. Schmidt, formerly production manager of Baker Bros., Inc., Toledo, O., has joined the Nelson Stud Welding Division of Morton Gregory Corp., Lorain, O., as a field engineer. His territory will be northwestern and central Ohio and northeastern Indiana.

* * *

Dr. G. V. Slottman has been appointed director of research and engineering for Air Reduction Co. He has been associated with Airco's development of steelmaking processes using large quantities of oxygen for combustion and chemical reagent purposes.

* * *

Joseph F. Ziemann and Troverse F. Schmidt will direct a new district sales office in Knoxville, Tenn., for Ansul Chemical Co., makers of dry chemical fire extinguishers.

* * *

Eugene S. Sheasby has been appointed general staff manager, general sales division, of United States Steel Supply Co. Paul C. Van Cleave has become district manager of the Los Angeles warehouse of the company.

* * *

Thomas E. Berry has been appointed manager of domestic sales for All-State Welding Alloys Co., Inc., White Plains, N. Y. He was eastern seaboard regional sales manager.

* * *

John A. Hill, president of the Air Reduction Co., Inc., has been elected a member of the board of directors of the Commerce and Industry Association of New York, Inc.

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TYPES 25, 43 and 52

Brazing 716

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Types 142, 195, 355 and 356

for Better Welding

3/16" size only

Aluminum Solder

White Metal

Welding Alloys Manufacturing Co.

744 Broad St., Newark 2, N. J.

HARRY NOOTER has been re-elected chairman of the board of John Nooter Boiler Works Co., St. Louis. ELMER J. NOOTER has been re-elected president. R. J. RYAN has taken the new title of executive vice-president. S. C. TRACEY is vice-president and treasurer. H. A. FRITH, also elected vice-president will continue as plant superintendent. HERBERT H. KOCH was named secretary.

* * *

WALTER A. JAYME has been promoted to general superintendent of the Gary, Ind., works of National Tube Co.

* * *

FRANK H. STOHR has been named general manager of the Allis-Chalmers Mfg. Co.'s Norwood Works.

* * *

MYRON ZUCKER has been named representative for the Precision Welder and Machine Co., Cincinnati, in southeast Michigan and Toledo, O.

* * *

MAC L. CREWS has joined the industrial sales force of Mine Safety Appliances Co., Pittsburgh, Pa.

* * *

HARRY S. DILCHER has been appointed manager of the plate and welding division of General American Transportation Corp., at Masury, O.

* * *

CHARLES FETTE has retired as superintendent of Republic Steel Corp.'s butt weld and continuous tube mills. ROY CASE has been named to replace him.

* * *

DR. GEORGE E. ZIEGLER and DR. CLAYTON O. DOHRENWEND have been appointed director and assistant director, respectively, of the Midwest Research Institute, Kansas City, Mo.

* * *

C. R. TERRY has organized the Terry Machinery Co., Hanna Bldg., Cleveland, as a sales agency for metal working machinery.

* * *

KEMPTON DUNN was elected vice-president and CYRUS E. BRUSH was elected secretary of the American Brake Shoe Co. at a recent meeting of the board.

* * *

PHILIP H. CLAPP, JR., has been appointed sales manager of the Engineered Castings Division of American Brake Shoe Co. JAMES J. NELSON has been named eastern manager of the National Bearing Division of the company. MAYNARD B. TERRY has been appointed vice-president of the American Brakeblok Division.

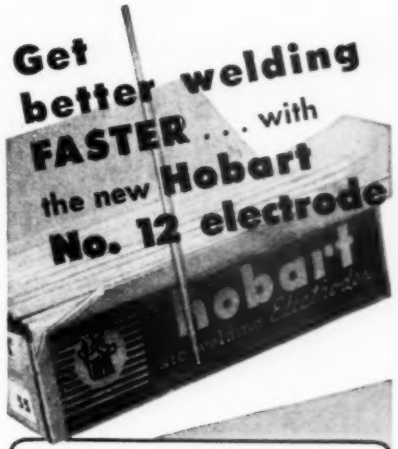
* * *

DR. EMORY N. KEMLER has been appointed associate director of Southwest Research Institute in Houston, Tex.

* * *

Died . . .

GEORGE S. HERREN, welding engineer for the Seagrave Corp., Columbus, O., died suddenly from a heart attack on January 28. Mr. Herren was interested in welding for many years and was one of the pioneers in the development of welded fire-fighting apparatus. He was one of the organizers of the Columbus Section of the American Welding Society and was secretary-treasurer of the section for the past eleven years.



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OXYACETYLENE TORCH

more skillfully on every-day welding jobs

HERE is a practical manual that explains both simple oxyacetylene welding techniques and the advanced methods and refinements that have been developed in the use of the oxyacetylene flame. You're taken in easy stages through flame cutting, bronze welding and brazing, the welding of various alloys to the specialized techniques now being used in pipe welding, the welding of light metals, etc.

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- Analyzing shop overhead
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By STUART PLUMLEY
Revised by T. B. Jefferson
Editor, The Welding Engineer
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YOU'LL find everything in this book from basic information on lighting and adjusting your torch flame to the pre-heating that insures best results in welding aluminum castings . . . everything from laying out a templet for cutting a 90-degree elbow to using a soft solder to smooth out dents in automobile fenders.

Detailed Instruction on Pipe Welding

Here's the information you need to make you a finished pipe weldor . . . how to prepare the edge of the pipe . . . mark the line of cut accurately . . . make a templet to cut a 90-degree Y-branch . . . weld a joint between pieces of 2-inch pipe . . . protect the wood-work during the welding of a pipe joint . . . what to do about expansion and contraction in welding large diameter pipe, and many other specific job aids.

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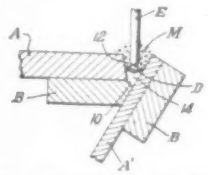
From the Patent Office

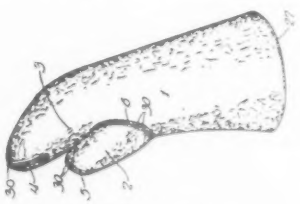
New Submerged-Arc Method

2,459,242. FRANK ROTHE, Niagara Falls, N. Y. Assigned to The Linde Air Products Co. Filed June 30, 1945. Issued Jan. 18, 1949.



The new feature of this submerged-arc process is a small fusible trough (D above) which only allows the powder to occupy the top part of the groove, leaving the bottom substantially empty. When welding starts, the trough melts and combines with the filler metal to complete the weld in a single pass.

* * *



Weldor's Glove

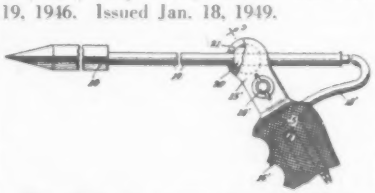
2,460,413. SANFORD J. ERRETT, Portland, Ore. Filed June 11, 1945. Issued Feb. 1, 1949.

The outer shell of a weldor's glove has a smooth seamless surface over its back and palm. A single seam extends across the finger tip end and along the finger edge. The thumb portion is attached to the hand portion with a seam around the base of the thumb. A seam also goes across the thumb tip and down the outer edge of the thumb. Glove liners are a pair of identical blanks fastened together with a marginal seam to make them usable with either left or right hand outer shells.

* * *

Soldering Iron

2,459,371. ALLEN T. FOSTER, Chicago, Ill. Assigned to Electric Soldering Iron Co., Inc., Deep River, Conn. Filed Dec. 19, 1946. Issued Jan. 18, 1949.



The shaft of a new electric soldering iron may be adjusted to different lengths for various size jobs by loosening screw (14 in drawing) and moving it to desired position. The handle is a flat finger-grip type through which the conductor runs.

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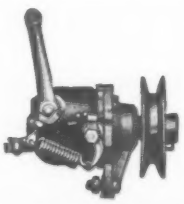

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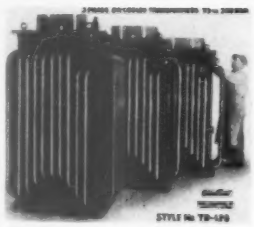

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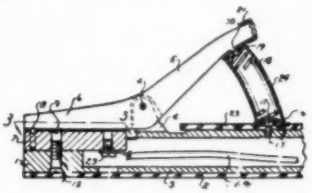
Electrode Holder

2,455,108. Hector Beauregard, Utica, Mich. Filed Oct. 8, 1945. Issued Nov. 30, 1948.

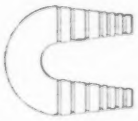


An electrode holder comprises a pair of pivoted members, one of which is of tubular form having a slot opening through one end. An insulating casing encloses the tube which has at its forward end a portion of greater thickness than the thickness of the tube. A copper block is secured in surface contact with the thicker portion of the tube and has a surface extending outwardly of the slot. The surface has a series of grooves at various angles to the longitudinal axis of the block. One of the pivoted members has a terminal portion parallel with the surface of the block when in contact.

* * *

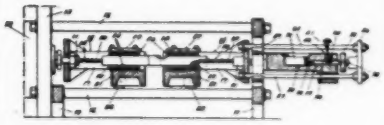
Pipe Fitting

2,449,754. Oskar Seitz, Baden, Switzerland. Filed Aug. 25, 1945. In Switzerland, Dec. 20, 1943. Issued Sept. 21, 1948.



A universal pipe fitting for welding pipe ends of the same or different diameters includes a unitary connecting member having at least one integral extension nipple of substantially tapering form. It comprises demarked integral severable sections each having a diameter at the point of demarcation corresponding to a standard pipe size. Upon the severance of any selected one, an end surface will be provided on the remaining unsevered part.

* * *



Spot Weld Tester

2,453,576. Fraser B. Jacob, Lynn, Mass., assigned to The Electroloy Co., Inc., Bridgeport, Conn. Filed Mar. 2, 1945. Issued Nov. 9, 1948.

A measuring head for a spot-weld coupon-testing device comprises a spring and means for transmitting movement from a gripping head of the device to the spring. Measuring means indicates the deflection of the spring and other means retain a reading of the indicating means. Last mentioned means comprises a plunger for transmitting movement from the spring to the indicating means. The plunger has a tapered notch and a friction pin resting in the notch and being urged against the tapered surface.

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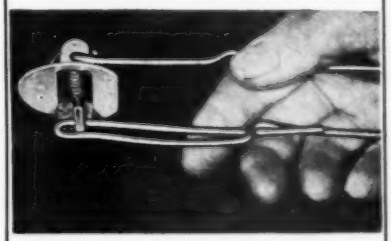

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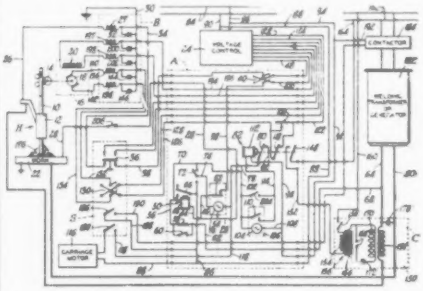
Automatic Arc Process

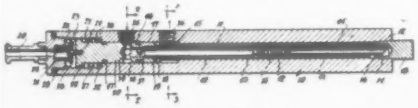
2,460,990. JOHN A. KRATZ, Yonkers, N. Y., and HENRY G. THOMA, Rutherford, N. J. Assigned to Linde Air Products Co. Filed Feb. 5, 1946. Issued Feb. 8, 1949.



Plug welding, intermittent welding and production-line welding are performed by a new process which involves high-frequency starting and automatic timing. A high-frequency potential is maintained between the workpiece and welding electrode, which is slowly fed toward the work. The h-f potential is automatically stopped and the work and electrode commence relative transverse motion when the voltage drops coincident with the start of welding. When the welding operation stops, the electrode continues to move transversely.

For submerged-melt plug welding the same process is utilized to feed a rod at a slow rate into a powdered flux toward a site for plug welding. The h-f potential stops and rod-feeding rate increases when welding potential drops with the start of welding.

* * *



Electrode Holder

2,460,889. EARL I. LARSEN, Indianapolis, Ind. Assigned to P. R. Mallory & Co., Inc., Indianapolis, Ind. Filed May 28, 1946. Issued Feb. 8, 1949.

An ejector-type resistance-welding electrode holder has its ejector operated by a piston. When the piston is moved to electrode ejecting position, it automatically closes the cooling fluid inlets and outlets.

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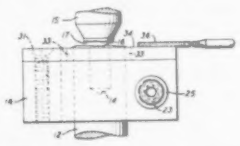

R-W Electrode Dresser

2,458,928. PERCY E. BROOKS, Woodridge, N. J. Assigned to Western Electric Co., Inc., New York City. Filed April 6, 1946. Issued Jan. 11, 1949.

Welding fixture for welders with two electrodes in parallel planes. It has a wear-resisting element around the first electrode. An insulating member is also adjustably mounted on the first electrode to support the wear-resisting element which acts as a guide for an abrasive tool to clean off the other electrode.

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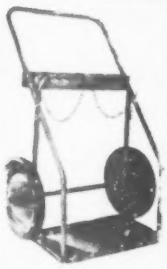

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